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REVIEW OF THE PRESIDENT'S CLIMATE ACTION PLAN

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDRED THIRTEENTH CONGRESS

SECOND SESSION

JANUARY 16, 2014

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ONE HUNDRED THIRTEENTH CONGRESS
SECOND SESSION

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REVIEW OF THE PRESIDENT'S CLIMATE ACTION PLAN

THURSDAY, JANUARY 16, 2014

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The committee met, pursuant to notice, at 9:15 a.m. in room 406, Dirksen Senate Building, Hon. Barbara Boxer (chairman of the committee) presiding.

Present: Senators Boxer, Vitter, Cardin, Whitehouse, Merkley, Booker, Carper, Inhofe, Crapo, Barrasso, Sessions, Fischer, Boozman, and Wicker.

Senator BOXER. Good morning, everybody. And I would ask the panel to take their seats, and I would ask the good Senator Udall to sit there at the end and he is going to introduce us to a member of the second panel. But knowing his schedule, we said we would allow him to go first.

We also want to note that Senator Inhofe, one of the great members of this committee, has to run to be a ranking member in his Armed Services Committee. So he is going to leave, preserve his early bird status and come back.

Senator INHOFE. I will.

Senator BOXER. So before we even do our opening statements, Senator Udall, we want you to be able to go to your next appointment. Please, go right ahead.

Senator UDALL. Thank you, Senator Boxer. Good morning to the committee. Thank you, Senator Vitter. I appreciate an opportunity to introduce a member of your second panel, but a man who looms large in our great State of Colorado, and that is former Governor Bill Ritter. He helped our State become a national leader in the new energy economy, and in our fight to combat global warming. He was our Governor from 2007, Senator Boxer, to 2011. He found really creative ways to grow a bipartisan consensus around the need for our State to develop job creating clean energy while also safeguarding our land and our air, our water, the features that make the Centennial State, look, I am going to be immodest here, we are the envy of the world.

[Laughter.]

Senator UDALL. He was raised on a farm, he brought that rural perspective to discussions about crafting an effective State policy of energy development.

Many of you have heard me talk about our strong renewable electricity standard. It is second only to the great State of California's. I helped lead that effort in 2004. We started out with a 10 percent requirement. We very quickly met that requirement, and then Governor Ritter came along and he built on that accomplishment and he led the effort, Senator Boxer, to whereby now we are going to triple the State's use of renewable energy to 30 percent by 2020.

Along the way he created the Governor's energy office, which was the first cabinet level office devoted to improving the effective use of Colorado's vast energy resources. He also signed Colorado's Clean Air-Clean Jobs Act, which moved us in the utility front from burning of coal in our front range power plants to the use of clean-burning natural gas. We reduced carbon emissions, we cleaned up our air, we created jobs. And that natural gas, it may have been from Colorado, Senator Inhofe isn't here, it may have been from Oklahoma, it may have been from Louisiana, Senator Vitter's State. So we are truly an all of the above energy State. We are now one of the leading States, because of Governor Ritter's great work in terms of the jobs created and total money invested in our growing clean energy economy.

Since we are here today to talk about climate action plans, I want to add that Governor Ritter issued Colorado's first climate action plan in 2007. It was a bold proposal, it called for a 20 percent reduction in greenhouse gas emissions by 2020, and an 80 percent reduction by 2050.

So what has Governor Ritter been doing since he left office in 2011? Well, he went up to CSU, our land grant college, Colorado State University, he created the Center for New Energy Economy at CSU. The Center promotes the growth of clean energy by working through, with leaders in government and the private sector, their pursuing business friendly policies that create jobs and promote investment in the clean tech economy. And the Center does this all the while through maintaining a commitment to the University's original land grant service mission, to benefit the people of Colorado.

The Center is expanding the innovative and entrepreneurial approach to clean energy research. Colorado State has long been known for that. It will play an integral role in bringing alternative energy solutions to the marketplace.

And I just want to end on this note, Chairman Boxer, and Ranking Member Vitter, I am really pleased, I know Senator Bennet is really pleased that you saw fit to invite the Governor here today. He has a lot to share with you. It is thanks to efforts like Governor Ritter's that I can say with confidence and pride that Colorado has a balanced approach to energy that is truly a model for our Nation. So I know you will enjoy hearing form Governor Ritter, and I know he looks forward to engaging in a back and forth with the committee. Again, thank you for inviting him, and I appreciate the time of the committee.

Senator BOXER. Thank you so much.

So we will go the 5-minute rule now.

OPENING STATEMENT OF HON. BARBARA BOXER, U.S. SENATOR FROM THE STATE OF CALIFORNIA

Senator BOXER. Today's hearing will cover three topics. First, the President's climate action plan, which is a critical issue. We have four agencies here today to address it. Senator Vitter and minority members of this committees stated in their December 2013 year-end report, Vitter and the EPW Republicans will continue pushing for an oversight hearing on the Administration's climate agenda that includes witnesses from Federal agencies.

Second, today's hearing will include the budget for the EPA, and third, we have set aside time for members of this committee to ask about John Beale, an outrageous con man who was finally caught and convicted. We held a briefing on this on September 30th. All members were invited. I asked many questions and Senator Vitter asked over 50 questions. However, Senator Vitter has more questions, so we are covering that subject, too.

The broad scope of this hearing was formally agreed to by ranking members.

The Wall Street Journal said in its editorial today that I am living in an EPA fairy tale for commending EPA Administrator McCarthy for shining a light on the actions of a rogue employee. Well, that is what Patrick Sullivan said, the Assistant Inspector General, when he said about Ms. McCarthy's role, "To our knowledge, the first senior person to express concerns was Ms. McCarthy." So I stand by what I said.

Now let me turn to the President's climate action. In his plan released on June 2013, President Obama called for action to fight climate change, so we don't condemn future generations to a planet that is beyond repair. I couldn't agree more, because climate change is a catastrophe that is unfolding before our very eyes. The President's plan lays out a road map for action. It calls for a wide range of reasonable steps to reduce carbon pollution, grow the economy through clean energy, prepare for future impacts, such as rising sea levels and storm surges, and lead global efforts to fight climate change.

When the President announced his climate change plan, many companies issued statements of support, including Wal-Mart, Honeywell, DuPont, Dominion Resources, American Electric Power and other business leaders. More than 500 companies, such as GM, Nike, Mars, Nestle, Unilever have stated that tackling climate change is one of America's greatest economic opportunities in the 21st century.

In addition to many of the Nation's largest companies, the American people have waited on the need to address this growing threat, and they want action now. A USA Today poll in December found that 81 percent of Americans think climate change will be a serious problem if nothing is done to reduce it. And 75 percent of Americans say that the U.S. should take action on climate change, even if other nations do less. That poll also found that Americans overwhelmingly support clean energy solutions like generating electricity from solar or wind.

And here is the thing about the American people. They all say this, not just Democrats, not just Republicans, not just Independents. The only place that we have a partisan divide is right here in the Congress.

Well, I am encouraged that significant action to address climate change is already underway, including establishing limits on carbon pollution from cars and trucks. The Obama administration is also working on carbon pollution limits for new and existing power plants. Together these efforts address the Nation's two largest sources of carbon pollution.

Now, a new peer-reviewed study in the journal Nature finds that unless we control carbon pollution, the most severe predictions by scientists and climate experts on rising temperatures will occur by the end of the century, resulting in the most significant and dangerous impacts from climate change, an increase of more than 7 degrees Fahrenheit by 2100.

In my home State of California, scientists have been telling us for years what would happen, for years. And they are right on target. Years ago, they said, there will be substantially higher temperatures, droughts, floods, extreme weather, extreme wildfires and rising sea levels. And it is happening. Future generations are going to look back to this moment and judge each of us, each of us, by whether we start to act on this issue.

So I look forward to hearing from today's witnesses who are leading their agencies' efforts to reduce carbon pollution. I will pledge to you that I will use every tool at my disposal to ensure that you work will be done. The reason is, it is a moral obligation, it is good for the economy and it is good for human health.

Thank you very much, and I would ask my ranking member to address us at this time.

OPENING STATEMENT OF HON. DAVID VITTER, U.S. SENATOR FROM THE STATE OF LOUISIANA

Senator VITTER. Thank you, Chairman Boxer, for calling today's hearing on the President's climate action plan. It is long overdue, quite frankly. In 2013, the committee failed to hold an EPA budget hearing and held only one climate hearing, which had excluded all Federal Government witnesses. Today's one hearing comes 7 months after the announcement of the biggest regulatory avalanche in U.S. history, the President's climate action plan. And this avalanche of regulatory actions will begin in 2014, and I believe will further frustrate our already struggling economy. Only a fraction of the jobs economists had hoped for were created in December.

Last June, when President Obama announced his climate action plan, it was clear to me that he didn't want his supporters to engage in straight economic arguments over promise on the impacts taking action will have or debate the validity of the claim that the science is already settled. In fact, there were White House talking points to that effect. However, these are topics that must be discussed.

While the current EPA Administrator argues that the President's climate action plan is part of an overall strategy positioning the U.S. for leadership in international discussions, her predecessor clearly argued that such action would have no impact without international participation first. For the purposes of facilitating international buy-in, the Administration is moving forward with a domestic agenda that will clearly damage our ability to utilize our abundant energy resources and to support the growth of manufacturing jobs.

I am afraid these policies just show the international community three things: how to undermine chances of economic recovery and growth, how to achieve the lowest work force participation rate since the Carter administration, and how to increase energy prices by denying the ability to utilize all energy resources. While these policies were squarely rejected by Congress in 2009, since then the President has simply sought to legislate them through administrative fiat.

President Obama promised his Administration would be the most transparent in history. However, his record, including here, reflects a determined effort to do the opposite. I think the social cost of carbon is a perfect example on point. Since last June, a number of my Republican colleagues joined me in asking the Administration to provide details on those social costs of carbon estimates which were developed in a black box and are used regulatory by multiple Federal agencies to justify costly regulations.

The first confirmation of even participation in these closed door meetings was acknowledged at a November EPW hearing by EPA's Director of Atmospheric Programs. She committed to providing further detailed information to the committee in November, and we got a short, terse, very superficial response to our detailed question this morning. I think that says it all.

Afterwards, the Administration gave in to pressure from Congress and the public and announced that the estimates would be noticed in the Federal Register and open to comment. Yet they are still being utilized in many ways across the Federal Government in rulemakings.

While the President's climate action plan includes a role for almost every Federal entity, the EPA is clearly at the core. I am very concerned that the EPA waited over 3 months to publish a second try at proposed greenhouse gas new source performance standards for power plants. I am even more concerned that I believe these roles are still contrary to Federal law. I think the EPA's delay is designed to postpone controversial news during an election year and give the EPA more time to make excuses about why they are taking action beyond the scope of their legal authority.

So in summary, I continue to be really concerned that the President's climate action plan has deeply flawed legal justifications and perceived theoretical benefits. I believe it undermines our economic recovery, threatens to keep off limits our energy abundance and manufacturing renaissance, exponentially increases Federal bureaucracy and red tape and most tragically, hurts those who can least afford it.

Thank you, Madam Chairman.

Senator BOXER. Thank you. Senator Cardin.

OPENING STATEMENT OF HON. BENJAMIN L. CARDIN, U.S. SENATOR FROM THE STATE OF MARYLAND

Senator CARDIN. First, Madam Chair, thank you very much for your extraordinary leadership on these issues during very challenging times. I thank you for holding fast on science, because the science is clear. Atmospheric science 101 teaches us that carbon-based gases in the atmosphere are what keep the planet warm and habitable by trapping heat around the planet. Earth's plants and oceans naturally help regulate and balance the level of carbon in the atmosphere by absorbing carbon. Since the industrial revolution, levels of carbon in the atmosphere have been steadily increasing, and the reduction of forest acres around the world have compounded these increases in carbon pollution emissions by reducing nature's carbon sequestration capacity. Therefore, increased levels of carbon gases in the atmosphere have led to more heat being trapped, which is changing the earth's climate.

We are accelerating by human activities the carbon emissions. It is having a catastrophic impact, and we have to do something about it. These are scientific facts. There isn't any debate in the scientific community on these facts. Neither is any debate among political leaders in any other developed nor many developing countries. Because unlike in the U.S. Congress, facts on climate change are accepted.

I urge my colleagues to think about how future generations will look back upon our political squabbling and inaction to legislate meaningful policies to curb carbon pollution and authorize action to adapt to our world's changing climate. After all, it will be our grandchildren and their children, not us, living in the world we leave them.

The effects of climate change can be seen around the world, across the United States and in my home State of Maryland. Scientists monitoring migrating patterns of fish and birds are seeing changes in these patterns as meteorological seasons are changing. In some instances, the changes in certain wildlife species, particularly cold weather and cold water adaptive species like trout and salmon, are shrinking, while the ranges of pest species like bark beetles are expanding due to milder winters. Changing water temperatures in the Chesapeake Bay will have an impact on our blue crabs and oyster populations, which will threaten the livelihood of Maryland's watermen, who make their livelihood off the seafood of the Bay.

Climate change is also directly affecting human population around the globe. This raises concerns about climate refugees, who have lost their communities to sea level rise and other catastrophic weather events in the decades to come. In my own State of Maryland, I can point to the people who live on Smith Island, as they see their island being consumed by sea level rise.

While I am disappointed that the politics of Washington prevents Congress from enacting legislation to address both the causes and effects of climate change, our Nation is very fortunate to have an Administration that is able to rise above the squabbles in Congress to take bold action to curb greenhouse gas emissions, promote more responsible and efficient energy consumption, grow our Nation's renewable energy sources and take critical steps to adapt to the effects of climate change. EPA has reduced U.S. vehicle fleet emissions through improved CAFE standards by setting ambitious yet achievable goals for fuel efficiency. The President's announcement in 2011 to raise CAFE standards to 54.5 miles per gallon by 2025 in sum are the world's most ambitious fuel economy standards in the world. These targets demonstrate how EPA and the industry can work together to achieve what is necessary to protect public health and the environment.

And I might point out, this is going to help our economy. Efficiencies of energy creates jobs, clean energy creates jobs.

President Obama's EPA has also taken bold and a necessary step toward regulating carbon pollution from our Nation's power sector by using existing authority under the Clean Air Act to propose the first limits of carbon emissions for the U.S. power generator sector. All of this is helping. The Obama administration has executed successful programs that are generating clean energy and American jobs, reducing our reliance on foreign oil, bolstering our national security and international competitiveness and protecting health and the environment.

We should help. Instead, what we see, particularly coming over from the House of Representatives, are proposals that would block this progress. Fortunately, we have stopped that in the Senate. But we should adopt an energy policy that will help this Nation not only become energy independent for our national security and not only help our economy grow but also help our environmental future.

Senator BOXER. Thank you very much, Senator.

Senator Crapo.

OPENING STATEMENT OF HON. MIKE CRAPO, U.S. SENATOR FROM THE STATE OF IDAHO

Senator CRAPO. Thank you, Madam Chairman, for holding this important hearing on the President's climate action plan.

I share many of the concerns outlined by my colleagues on this panel and welcome this opportunity to hear from the Federal officials assembled on the first panel who have and will continue to generate the President's core policies on climate change. Many of my concerns with the President's current action plans stem from issues that we have wrestled with in this Administration in the past.

For instance, the Environmental Protection Agency has without providing for public comment or peer review adjusted upwards the social cost of carbon to modify the accounting for benefits claims from regulatory actions. Moreover, proposed regulations of greenhouses gases from new and existing sources are likely to cripple numerous large scale manufacturing and energy projects across the Nation, creating an environment in which foreign countries will become far more attractive for future investment, potentially undermining our economy again.

In another instance, the Treasury Department obstructed multiple transparency requests for more than 9 months regarding internal work on the development of a carbon tax, as well as sources of funding for international climate commitments that were negotiated behind closed doors.

We can all agree that affordable energy is a critical component of having a healthy and robust economy in the United States. And we are fortunate to have tremendous energy resources here at home. As such, I am concerned that the Administration's proposals threaten to undermine an important sector of our economy and the industries and jobs it supports in the name of modest environmental gains. In reviewing the testimony provided by members of President Obama's Administration today, I am concerned that the views of those most likely to be negatively impacted by the new EPA regulations have not been appropriately considered.

Protecting and improving our natural environment is a goal shared by many. But there is strong disagreement about how to achieve these goals. In general, the best policies for addressing climate change are grounded in three basic principles: sound peer-reviewed science, protection of our quality of life; and policies that promise the greatest benefit to both the environment and the people without harming our economy.

The recent climate change proposals issued by President Obama, however, will have severe economic consequences and will likely yield immeasurable environmental benefits if fully implemented. Further, they would undermine the utilization of our own traditional affordable sources of energy and increase the cost of electricity for consumers. Rather, we must utilize an all of the above approach which should include a robust expansion of nuclear energy production, hydroelectric power and other promising renewable and emissions reducing technologies. By expanding and diversifying our energy portfolio, we can reduce risks to the environment, promote a strong domestic energy sector and increase our energy security.

I support legislative solutions that preserve and enhance our natural environment. However, I am deeply concerned that unilateral EPA regulation of greenhouse gas emissions is already imposing major burdens on our economy without resulting in commensurate environmental benefits. I agree on the need for continued research in the field of climate science in order to gain the necessary knowledge needed to implement effective policies. The issue is fraught with significant social, environmental and economic consequences, and it is essential that we get it right.

As such, I look forward to hearing from our witnesses today, particularly Dr. Judith Curry, and her work at the Georgia Institute of Technology.

Again, thank you, Madam Chairman, for holding this hearing. I look forward to hearing from our witnesses.

Senator BOXER. Thank you so much, Senator.

Senator Whitehouse.

OPENING STATEMENT OF HON. SHELDON WHITEHOUSE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Senator WHITEHOUSE. Thank you very much, Madam Chair.

Let me just briefly welcome our witnesses to this chamber, one in which reality is so often suspended, one in which science is so often twisted and mocked and one in which the power of special interests to manipulate American democracy is often so nakedly revealed.

My belief is that the propaganda machine behind the climate denial effort will go down in history as one of our great American scandals, like Teapot Dome or Credit Mobilier or Watergate, for that matter.

Most Americans see through it. Major American organizations, everything from Coke and Pepsi to Ford and GM to Wal-Mart and Nike and Apple, you can go on and on through the corporate community, outside the corporate community you can go from the Joint

Chiefs of Staff to the U.S. Conference of Catholic Bishops to the Garden Clubs of America, over and over again, organization after organization accepts the science, accepts the reality. And frankly, farmers and fishermen are starting to see it happen on their farms and in their fishing grounds in their reality. Ask the ski mountains of Utah.

So I simply urge you all while you are here to keep the faith. Keep faith with reality. Keep faith with truth, keep faith with science. Armor yourselves against the slings and arrows of the deniers and the polluters machine and do our duty. I ask this particularly on behalf of my home State, Rhode Island, which is a coastal State, which is at the front line of the undeniable effects of climate change. Our sea levels are rising. It is not complicated. You measure that with a yardstick, more or less. Our oceans are warming. Not complicated. You measure that with thermometers.

And we know that our oceans are getting more acidic. Everybody with an aquarium can take a litmus test. This is not complicated. And it is affecting our people.

So bear that in mind, do our duty and thank you. I ask that the remainder of my statement be put into the record.

[The referenced statement was not received at time of print.]

Senator BOXER. Without objection, it will be done.

Senator Sessions, you are next followed by Senator Barrasso. That is the list we have, but it is up to both of you.

Senator SESSIONS. Senator Barrasso was here before I came.

Senator BOXER. Then absolutely, Senator Barrasso.

OPENING STATEMENT OF HON. JOHN BARRASSO, U.S. SENATOR FROM THE STATE OF WYOMING

Senator BARRASSO. Thank you very much, Madam Chairman.

Madam Chairman, last week was the 50th anniversary of the war on poverty. The war began when President Lyndon Johnson visited with Tom Fletcher and his family on the front porch in Martin County, Kentucky. NPR did a story on this recently and said at the time, the poverty rate in this coal mining area was more than 60 percent. Johnson visited the Fletchers on the porch of their home, a small wooden structure with fake brick siding. This is from the NPR story. The study went on to say that photographers took what would become one of the iconic images of the war on poverty. The President crouched down, chatting with Tom Fletcher about the lack of jobs.

Flash forward to today, according to the Department of Agriculture, the latest numbers for 2011, 38.6 percent of the population of Martin County is in poverty. NPR stated that this is twice the national average. In addition, 47 percent of children in that county are in poverty. NPR went on to say today, many people here rely on government aid. In fact, it is the largest source of income in the county. They say people say it has helped to reduce hunger, improve health care and given young families a boost, especially at a time, NPR said, when coal mining jobs, let me repeat, when coal mining jobs are disappearing by the hundreds.

Now, this is National Public Radio, not known as a conservative outfit that champions coal. Those are the ones saying that.

The actions of this Administration's EPA to wipe out coal and eventually natural gas is costing thousands of jobs, and it is driving up energy costs for many of the most vulnerable people in this country. I can only conclude that this EPA is on the wrong side of the war on poverty. In fact, this EPA is the tip of the spear that is spending energy producing communities like Martin County, Kentucky, like Campbell County in my home State of Wyoming, Marshall County in West Virginia, Belmont County in Ohio back to the very days before Lyndon Johnson's original declaration.

When you wipe out the jobs in these communities and you drive up electricity costs, you create poverty, period. Folks back in those counties wonder why the EPA is making these decisions that deliberately hurt them. The Associated Press shed some light on this with an article written January 10th of this year, just 6 days ago. The article demonstrates that the EPA has been colluding with the Sierra Club and their Beyond Coal campaign to deliberately draft a rule that will prevent new coal-fired power plants from being built. According to the Associated Press article, e-mails between the Sierra Club and the EPA produced through a Freedom of Information Act lawsuit show the green group and senior officials of the Nation's top environmental enforcer met and corresponded frequently about the agency's work on coal regulations. The article goes on to say that the EPA has repeatedly said the regulations on coal-fired plants will not be a death blow to the industry. However, the agency was working closely behind the scenes with the Sierra Club, an environmental organization that was pushing the agency to adopt standards that would be impossible for power plants to meet.

Many of the e-mails are between John Coequyt, head of the Sierra Club's Beyond Coal campaign, and the EPA's Michael Goo and Alex Barron, both in the agency's Office of Policy at the time. Just yesterday, a report of new e-mails obtained from the Freedom of Information Act show more coordination between the EPA and extremist environmental groups. The report stated, "E-mails show EPA used official events, official events, to help environmentalist groups gather signatures for petitions on agency rulemaking, incorporated advance copies of letters drafted by those groups into official statements by the agency and worked with these environmental extremist groups to publicly pressure executives of at least one energy company."

Madam Chairman, I cannot believe that these are the first instances of this type of collusion in this Administration's EPA. It is clear that this EPA and this Administration has an agenda. And that agenda is hurting jobs, the agenda is raising energy costs and the agenda is making poverty worse in struggling communities around this country. The message to energy producing communities is clear: if you like your job, your community and your electricity bill, you can't keep them.

Thank you, Madam Chairman.

[The prepared statement of Senator Barrasso follows:]

STATEMENT OF HON. JOHN BARRASSO, U.S. SENATOR FROM THE STATE OF WYOMING

Thank you, Madam Chairman.

Last week was the 50th anniversary of the war on poverty. This war began when President Lyndon Johnson visited with Tom Fletcher and his family on their front porch in Martin County, Kentucky. NPR did a story on this iconic moment, and stated, "At the time, the poverty rate in this coal-mining area was more than 60 percent. Johnson visited the Fletchers on the porch of their home—a small wooden structure with fake brick siding. Photographers took what would become one of the iconic images of the war on poverty: the President crouched down, chatting with Tom Fletcher about the lack of jobs."

Flash forward to today. According to the U.S. Department of Agriculture's latest numbers for 2011, 38.6 percent of the population of Martin County is in poverty. NPR stated that this is twice the national average.

In addition, 47 percent of children in the county are in poverty. NPR went on to say that "Today, many people here rely on government aid. In fact, it's the largest source of income in Martin County. People say it has helped to reduce hunger, improve health care and give young families a boost, especially at a time when coal mining jobs"—let me repeat—"coal mining jobs . . . are disappearing . . . by the hundreds." This is National Public Radio, not known as a conservative outfit that champions coal, saying this.

The actions of this Administration's EPA to wipe out coal, and eventually natural gas, is costing thousands of jobs and driving up energy poverty for the most vulnerable. I can only conclude that this EPA is on the wrong side of the war on poverty. In fact, this EPA is the tip of the spear that is sending energy producing communities like Martin County, Kentucky, Campbell County in my home State of Wyoming, Marshall County in West Virginia, and Belmont County in Ohio back to the very day before Lyndon Johnson's original declaration.

When you wipe out the jobs in these communities, and you drive up electricity costs, you create poverty, period. Folks back in these counties wonder why the EPA is making these decisions that deliberately hurt them. Well, the Washington Free Beacon shed some light on this in an article written on January 10th of this year.

The article demonstrates that the EPA has been colluding with the Sierra Club and their Beyond Coal campaign to deliberately draft a rule that will prevent any new coal-fired power plants from being built. According to the article, "E-mails between the Sierra Club and the EPA produced through a Freedom of Information Act (FOIA) lawsuit show the green group and senior officials at the nation's top environmental enforcer met and corresponded frequently about the agency's work on new coal regulations."

The article goes on to say that "The EPA has repeatedly said the regulations on coal-fired power plants will not be a death blow to the industry. However, the agency was working closely behind the scenes with the Sierra Club, an environmental organization that was pushing the agency to adopt standards that would be impossible for power plants to meet. Many of the e-mails are between John Coequyt, head of the Sierra Club's 'beyond coal campaign,' and the EPA's Michael Goo and Alex Barron, both in the agency's office of policy at the time."

And just yesterday, the Washington Free Beacon reported new e-mails that show more coordination between EPA and extremist environmental groups. The paper stated, "E-mails show EPA used official events to help environmentalist groups gather signatures for petitions on agency rulemaking, incorporated advance copies of letters drafted by those groups into official statements, and worked with environmentalists to publicly pressure executives of at least one energy company."

Madam Chairman, I can't believe these are the first instances of this type of collusion in this EPA. It is clear that this EPA and this Administration has an agenda, and that agenda is not to create jobs, provide affordable energy, or fight poverty in these struggling communities.

The message to energy producing communities is clear—if you like your job, community, and your electricity bill, you can't keep them.

I thank the Chair and look forward to the testimony.

Senator BOXER. Thank you, Senator.

I ask unanimous consent to place into the record an article entitled The Future of Coal. Despite the gas boom, coal is dead. It goes on to talk about how, over the 20 years, employment is down because people are more productive, production is actually up. That is No. 1. And No. 2, I want to put into the record news today that the third quarter GDP went up 4.1 percent compared to the last quarter of George W. Bush where GDP went down 3.8 percent and that was the time that the Administration then was arguing over they couldn't do anything about greenhouse gases, that it wasn't actually in the Clean Air Act.

[The referenced information follows:]

http://online.wsj.com/news/articles/SB10001424052702303332904579228160256043626?mod=WSJ_hpp_LEFTTopStories

The Future of Coal: Despite Gas Boom, Coal Isn't Dead

Production Is Booming in Western U.S. to Feed Power Plants at Home and Abroad

By
John W. Miller And
Rebecca Smith
Jan. 6, 2014 12:53 p.m. ET

Last year was a tough one for the coal industry.

James River Coal Co. JRCC +1.39% laid off a quarter of its workers. Consol Energy Inc., CNX +0.24% which has mined coal since the Civil War, sold five Appalachian mines, representing nearly half its coal output. And more than a half-dozen U.S. coal-mining companies went under, beset by new environmental rules and competition from low-cost natural gas.

But coal isn't going away.

Coal remains the biggest source of fuel for generating electricity in the U.S. and coal exports are growing fast. Even as coal production plunges in the green hills of Appalachia, it is booming in the open-pit mines of Wyoming and under the plains of Illinois and Indiana.

Overall, U.S. coal production is projected to remain relatively constant over the next three decades, according to the U.S. Energy Information Administration.

"Coal's future is strong; it's just not a growth story" in the U.S., says Consol President Nick Deluliis.

Demand is being stoked by the rise of power-hungry middle classes in emerging economies, led by China and India. By the end of this decade, coal is expected to surpass oil as the world's dominant fuel source, according to a recent study by consultant Wood Mackenzie.

Two-thirds of coal's growth will be driven by demand for electricity in China, the firm says. "China's demand for coal will almost single-handedly propel the growth of coal," William Durbin, Wood Mackenzie's head of global markets, said in a recent speech.

Concern over the links between climate change and carbon emissions linked to coal could reduce consumption. Assuming weak economic growth and the strictest environmental rules, global coal demand could drop to 3.3 billion tons in 2035 from around five billion today, according to the International Energy Agency. But if politicians and regulators decide that the benefits of coal outweigh the environmental risks and craft looser regulations, coal demand could rise to six billion tons, the agency says.

In the U.S., coal is consolidating. Two counties in Wyoming account for 40% of U.S. coal production. And four companies— Peabody Energy Corp. BTU -2.02% , Arch Coal Inc., ACI - 0.45% Alpha Natural Resources ANR -1.99% LLC and Cloud Peak Energy Inc. CLD -0.11% — control 52% of U.S. coal production. Twenty years ago, the top four companies controlled less than 30%.

The decline of the coal industry in the eastern U.S. has hit isolated towns in places like eastern Kentucky and West Virginia's Mingo County, uprooting families and decimating local economies. The number of people employed in U.S. coal mining has declined to 120,699, down nearly 15% from 20 years ago, although production has increased slightly over that time.

Michael Marcum, a 41-year-old from Wise, Va., says he has worked coal jobs, mostly driving trucks, his whole life. In 2010, he made $98,000 as a truck driver hauling coal.

Now the father of two is making $500 a week, about a quarter as much. He was able to afford a Christmas present only for his younger child, he says and is thinking of moving to Alabama. "Here, there's no training, no factories, nothing. What are you supposed to do?"

Coal companies say Appalachian coal has become too expensive to mine. Ten years ago, Peabody Energy, the nation's largest coal producer, decided to move west and overseas. "It all comes down to geology," says Chief Executive Greg Boyce. "You've got a district [in the East] that's been mined for 100, 120 years; conditions were difficult."

Peabody bought mines in Australia and expanded into producing higher-grade metallurgical coal for the steel industry, which has better profit margins than the thermal coal used to generate electricity.

Mines in Wyoming's Powder River Basin offer a healthy future for the U.S. coal industry, Mr. Boyce says. "We have the largest mine in the world there, and it has one of the lowest cost structures for a mine of its size," he says. "The coal there travels to all corners of the world."

Exports are the U.S. coal industry's brightest hope. The country shipped out 114.2 million tons in 2012, more than triple the level a decade earlier. Coal-export revenue meanwhile jumped to $14.8 billion from $1.6 billion.

In 2012, the country's biggest coal customer was Canada, which consumed 42% of U.S. exports. Now the top three customers are the Netherlands, Britain and China. European coal imports have boomed as its gas supplies taper off and it tries to wean itself from nuclear power. European environmental regulations that take effect in 2015 threaten to reduce coal demand, but power plants on the continent are installing pollution-control mechanisms that could keep their demand for U.S. coal from plunging.

The International Energy Agency recently warned that the U.S. coal industry will have a difficult time competing with Indonesia, Australia and Russia in export markets, however. Some U.S. rivals in selling coal to Asia are closer, reducing shipping fees, with lower labor and environmental costs.

"The U.S. will be the high-cost marginal supplier in the Asia market," says Laszlo Varro, head of the agency's gas, coal and power division.

The U.S. electric-power industry remains a huge customer. During the first eight months of last year, 39% of U.S. electricity came from coal, down from 55% in 1990. Natural gas accounted for 27% through August of last year, up from 17% a decade earlier, as hydraulic fracturing technology has spurred gas production. Coal is expected to decline several percentage points over the next three decades as use of natural gas climbs, the Energy Information Administration says.

American Electric Power Co. AEP +0.04% , which owns utilities in 11 states, generated 86% of its electricity from coal just a few years ago, making it the biggest buyer of coal in the U.S. For the first nine months of last year, coal accounted for 76%. CEO Nick Akins projects the figure will bottom out at 50% to 60% by next year.

One reason that coal won't disappear soon is that regulators are reluctant to let utilities become too dependent on natural gas, fearing that a sudden price jump could send electricity prices soaring. Also, utilities have billions of dollars invested in plants that haven't been paid off. It often makes sense to let plants keep running until their debts are cleared; otherwise, utility customers wind up paying for unproductive assets.

Senator BOXER. So I think we really need to balance this out. And now we are going to go to Senator Merkley.

OPENING STATEMENT OF HON. JEFF MERKLEY, U.S. SENATOR FROM THE STATE OF OREGON

Senator MERKLEY. Thank you, Madam Chair. No matter where you travel in our State, you see the assault of carbon pollution on our natural resources. We can take and start with farming. We have had three worst ever droughts in the Klamath Basin in a 13-year period. And based on the snow pack this year, we may well have a fourth this coming summer, devastating a key agricultural part of our State.

If we turn to fishing, we have streams that are smaller and warmer, affecting our trout and our salmon. A lot of folk certainly appreciate having vital streams with vitality, if you will, and do not appreciate this assault of carbon pollution on our fishing.

If we turn to our sea life off the coast, we are having trouble with oyster seed, the baby oysters that are distributed throughout the industry to create the oyster industry. They are having trouble because there is more carbonic acid in the ocean. Why? Because of the carbon pollution. Carbon pollution assaulting our natural resource base.

And if we turn to our forests, the concern is even more evident. We have pine beetle infestations that are out of control because we don't have the cold snaps, cold enough and long enough to kill them off in the winter. We have large red zones that I have taken tours from the air in that you see red trees as far as the eye can see as a result. And we have forest fires that are the worst ever in a hundred years summer before last, and year after year with drier forests, more lightning strikes, more devastation. Part of that, certainly a piece of it, has to do with forest health, which is why I am lobbying the Administration to continue forest health money for us to be able to reduce the load enforcement.

A lot of it has to do with these changing patterns. In fact, the Department of Energy has an early version of their study from Los Alamos National Laboratories that says that western forests will be largely wiped out by the year 2100 with the combination of forest fires and beetle devastation.

So for the people of Oregon, in our rural areas, who see this devastating attack of carbon pollution affecting their fishing and farming and forestry, we need to stand up for rural America. We need to stand up for our natural resources, we need to stand up for this planet.

And I look forward to your comments. Thank you.

Senator BOXER. Thank you.

Senator Inhofe would like to be heard next. Is that OK with colleagues?

Senator SESSIONS. It would be OK with me, Madam Chair.

OPENING STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. This is one of those times we have the Armed Services hearing at the same time, as you well know, Senator Sessions.

On multiple occasions and most recently on May 30th of last year, President Obama has said, and this is a quote that he has used several times, he said the temperature around the globe is increasing faster than was predicted even 10 years ago, and that climate is warming faster than anybody anticipated 5 or 10 years ago. Both statements are false, and through letters to you, and I appreciate very much the quick response I got from you, Ms. McCarthy, and on the record of this committee, we have asked the EPA to provide us with the data backing up these two statements, the two statements made by the President.

But they didn't have the data, and referred us to the U.N. IPCC, Intergovernmental, and their scientists, apparently the EPA thought they were the source of this. Well, we went there and they had nothing to back it up, so apparently the President just made that up. And I think it is very important, because when you get statements that are made that are supposed to be based on logic and on truth, you have to check them out. Last week's record cold temperatures brought global warming debate back to the public's attention, but that is only important to the extent that it is bringing more awareness to the uncertainty of the science around the debate. When you go back and look at the temperature projections from the climate models and compare them to actual temperatures, two things are readily evident. First, temperatures have flat-lined over the last 15 years. And second, an average of over 100 climate models from the last decade show that the scientific community did not predict this would happen. To my knowledge, not a single climate model ever predicted that a pause in global warming would ever occur. Senator Sessions is going to go deeper into this.

The truth completely contradicts the Presidents' statement and begs the question as to why he and the EPA not only continue to deny the truth of it, but why it has raced to stop this information from disseminating into scientific record. What I am referring to is the Administration's efforts with other nations to lobby the IPCC to back up the President's statement in the most recent report. And while I did not think the IPCC hiatus explanation was sufficient, I have to at least give them credit for recognizing the facts for what they are and that the hiatus has occurred and does exist, is existing today.

I know the Administration and I will never agree on the science of global warming, but we can set aside for now and focus perhaps on the more alarming issue, the politics of EPA's regulations.

In October 2012, when I was ranking member of this committee, I released report highlighting the Administration's systematic actions to delay finalization of costly environmental regulations until after the 2012 presidential election. Whether it was the farm dust rule or the ozone standards, the President punted regulation after regulation until after the election to minimize the influence this would have on voters. Again, it appears he is doing exactly the same thing for the first round of greenhouse gas regulations for the construction of new power plants.

As we know, this is because under the Clean Air Act, this is significant, new rules for power plants must be finalized within 1 year of the proposal's publication in the Federal Register, or the proposed rule is invalidated. This is important, because after announcing the climate action plan, the President ordered the EPA to issue a new proposal by no later than September 20th of 2013.

Now, the EPA proposed a new rule on September 20th, but it didn't publish the Federal Register until after January 9th of 2014. Had the EPA published the rule in the Federal Register on the same day it proposed it, on September 20th, it would have been forced to finalize the rule by September 20th of 2014, which is about 6 weeks prior to the 2014 elections. But because the agency delayed the publication until last week, the EPA will not be required to finalize the rule until 8 weeks after the election.

This reveals an astonishing double standard. On one hand, the President says that we don't have time to delay action on global warming. He says we must act before it is too late. But on the other hand, his actions show it is OK to wait to finalize rules that will harm the economy until after the elections, so they won't have an impact on the vulnerable candidates that might be damaged by this.

Ultimately, this hypocrisy reveals the Administration is fully aware that the EPA's greenhouse gas regulations will put a drag on the economy. Study after study has shown that greenhouse gas regulations will cost the economy between $300 billion and $400 billion a year. If we remember, the predecessor of Ms. McCarthy said before this committee that even if we did pass these, it wouldn't have an effect of reducing greenhouse gases worldwide because it would only affect the United States.

Let me say to Ms. McCarthy, thank you very much for your very kind condolences over the problem that we had. Thank you, Madam Chairman.

[The prepared statement of Senator Inhofe follows:]

STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

On multiple occasions, and most recently on May 30th of last year, President Obama has said that "the temperature around the globe is increasing faster than was predicted even 10 years ago" and that "the climate is warming faster than anybody anticipated 5 or 10 years ago."

Both statements are false, and through letters to you, Ms. McCarthy, and on the record in this Committee, we've asked the EPA to provide us with the data backing up these statements, but they don't have any data and referred us to the U.N. IPCC. They had nothing to back it up, so President Obama just made it up.

Last week's record cold temperature brought the global warming debate back to the public's attention, but that's only important to the extent that it's bringing more awareness to the uncertainty of the science around the debate.

When you go back and look at the temperature projections from climate models and compare them to actual temperatures, two things are readily evident: (1) temperatures have flatlined over the last 15 years; and (2) an average of over 100 climate models from the last decade shows that the scientific community did not predict this would happen.

This fact completely contradicts the President's statements and begs the question why he and the EPA not only continue to deny the truth but why it has raced to stop this information from disseminating into the scientific record.

What I'm referring to is the Administration's efforts, with other nations, to lobby the IPCC to back up the President's statements in their most recent report. And while I did not think the IPCC's hiatus explanation was sufficient, I have to at least give them credit for recognizing the facts for what they are: that the hiatus has occurred and does exist.

I know this Administration and I will probably never agree on the science of global warming. But we can set that aside for now and focus on perhaps the more alarming issue—the politics of the EPA's regulations.

In October 2012, when I was Ranking Member of this Committee, I released a report highlighting the Administration's systematic actions to delay the finalization of costly environmental regulations until after the 2012 presidential elections. Whether it was the farm dust rule or the ozone standard, the President punted regulation after regulation until after the election to minimize the influence these rules would have on voters.

And it appears that he's doing the exact same thing with the first round of greenhouse gas regulations for the construction of new power plants.

And we know this because under the Clean Air Act, new rules for power plants must be finalized within 1 year of the proposal's publication in the Federal Register, or the proposed rule is invalidated. This is important because after announcing his Climate Action Plan, the President ordered the EPA to "issue a new proposal by no later than September 20, 2013."

The EPA proposed the new rule on September 20, but it did not publish it in the Federal Register until January 9, 2014.

Had the EPA published this rule in the Federal Register on the same day it proposed it, on September 20, 2013, it would have been forced to finalize the rule by September 20, 2014, about 6 weeks before the 2014 elections. But because the Agency delayed the publication until last week, the EPA will not be required to finalize the rule until January 2015, about 8 weeks after the 2014 elections.

This reveals an astounding double standard. On the one hand, the President says that we don't have time to delay action on global warming. He says we must "act before it's too late." But on the other hand, his actions show it is OK to wait to finalize rules that will harm the economy until after the elections so they won't have an impact on vulnerable Senate Democrats who face voters this fall.

Ultimately, this hypocrisy reveals that the Administration is fully aware that the EPA's greenhouse gas regulations will put a drag on the economy. Study after study has shown that greenhouse gas regulations will cost the economy $300 billion–$400 billion per year and will stunt economic growth for generations.

They would be the largest tax increase in American history, and our economy simply cannot afford them. And more importantly, by this Administration's own admission, the whole implementation of the rule would not reduce GHG emissions worldwide because it would only apply to the United States. So it would be the largest tax increase in American history for nothing.

Senator BOXER. Thank you so much, Senator Inhofe.

And we turn to Senator Booker.

OPENING STATEMENT OF HON. CORY A. BOOKER, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator BOOKER. First of all, I want to say thank you to the ranking member and to the chairwoman for this opportunity. This is my first hearing on this committee, and it is a privilege and honor to be here, especially with committed activists on both sides of the aisle who have a passion and concern for our country and its well-being. So it is an honor to be here as I begin my Senate career.

Chairwoman, it was a long time ago that I was the mayor of New Jersey's largest city. That was back in October. What frustrated me is, I am a guy who believes very strongly in the power of markets, in the power of private enterprise and industry to help poor communities, creating jobs, creating economic activity, lifting people up. That is the idea of this country.

But what I get frustrated with about having been a mayor as I look at the landscape of my city, and frankly the landscape of the State of New Jersey, is that we have it backward in our history about what it means to do private enterprise. All over Newark and New Jersey right now is a population as a whole paying the costs of corporations who did not internalize their pollution. Think about this right now. When I was mayor of Newark, the government had to spend, and somewhere there were Federal dollars, cleaning up brownfields where corporations of past years, decades and centuries ago, poisoned our ground, just to try and get it ready for economic opportunity. In Newark we have an incredible river, the Passaic River, running through New Jersey and Newark, that is so polluted right now that not only will it cost this Federal Government, as well as the State government, as well as past polluters, trying to chase them down and legal fees and legal costs, millions and tens of millions and hundreds of millions of dollars to ever get that river clean enough, but it also killed entire industries.

Everywhere around my State, dozens and dozens of Superfund sites that we are paying for as a population. I am all for the power of markets. But this idea that we are privatizing profits and socializing costs has to stop. And the pain and suffering of especially poor populations is something that you cannot put a price tag on.

What would it mean for people in America to live in a place where you can't plant in your ground to grow vegetables in your back yards? We did urban agriculture in my city, acres of it, and we could not go into the ground. We had to put the soil on top. Who is paying that cost? What does it mean in a city when you are separated from your air, as we have epidemic asthma rates? What does it mean to a people that is separated from their water, where they can't even go swimming? Who is calculating those costs?

So I am happy that the Federal Government over the years has caught up to a lot of these polluters and begun to put the regulations in place. But I am telling you right now, they are too late. So much land should be developed in economic activity, and it can't be touched. We have an Agent Orange site in New Jersey that is capped over. So here we are today, at another verge of being too late. And again, poor people who desperately need economic opportunity are being denied that in communities all over New Jersey. Why? Because look, when the temperature rises on our planet, please know that cities like Newark, New Jersey, are many degrees higher because they lack permeable surfaces, their tree canopy isn't there, and they are suffering as a result. These cannot be calculated, these negative externalities cannot be calculated.

So what I am simply saying is, I cannot stand by and allow the continued socialization of costs and allow those who are doing the polluting not to be held accountable for factoring those costs into their business. The epidemic asthma rates that are causing a generation of children to miss school, talk to teachers in urban areas, not just in New Jersey, and see what asthma does to undermine the education of children and therefore undermine their future economic viability, contribution, success that drives our whole economy, you understand the peril we are in.

I end with the simple words of Martin Luther King, a hero to Republicans and Democrats. He said, we are now faced with the fact, and it seems that we want to ignore many facts in our day and age. He says, we are now faced with facts, my friends, that tomorrow is today. We are confronted with the fierce urgency of right now. In this unfolding conundrum of life and history there is no such thing as being too late. We cannot afford to be too late and tarry away in needless and senseless discussions and undermine our ability to act and link people who put these pollutants into our air take responsibilities for the costs that they take.

I do believe that the problem, as King said, is not the vitriolic words and actions of bad people, it is the appalling silence and inaction of the good people. We are good people. I hope that we can act on this urgent need and urgent problem. Thank you.

Senator BOXER. Thank you for that eloquence.

And we turn to Senator Sessions.

OPENING STATEMENT OF HON. JEFF SESSIONS, U.S. SENATOR FROM THE STATE OF ALABAMA

Senator SESSIONS. Thank you. It is a fair question to ask this morning, what is right and what is wrong with the President's climate agenda. That is what we are paid to do, is to try to do the right thing for America and wrestle through these issues. What is right, first, I have said repeatedly it seems logical that greenhouse gas increases could, all things being equal, result in a warming effect in our atmosphere. Scientists have told us that. It is an important scientific question and there are smart and justifiable steps that can be taken.

For example, I have supported funding climate research, research into potential new technologies, cleaner sources of energy, common sense ways to promote energy conservation and efforts to expand nuclear power, the most significant emission-free energy source in the world, I would suggest. I have supported in the past ethanol, solar and other renewables and gas mileage rules, CAFE standards. But the truth is that predictions of warming simply have not occurred at the rate the experts have predicted. This rush to force billions more dollars of cost in this economy, many more thousands of people laid off, based on predictions that are not panning out deserves analysis. There is common ground that we can reach, things that we can do together. And there are certain things that I oppose and do not believe can be justified.

What is wrong with the President's plan? I would suggest four concerns. One, the President's plan lacks balance between cost and benefit. This Administration, primarily through EPA, is imposing a massive, bureaucratic, expensive plan that threatens to kill thousands of jobs and increase energy costs for American families. It will hammer middle class working families and make our economy less competitive.

Last month the economy added just 74,000 jobs. For every one job added, nearly five left the work force. That is not good. Today we have the lowest workplace participation rate in 36 years. We still have fewer jobs today than in 2008. And the President's climate agenda is hindering our economic recovery. Just look at the thousands of jobs awaiting approval on the Keystone Pipeline, which is being blocked.

Significantly, the amount taxpayers are being asked to pay for this agenda is out of balance. A recent report by the CRS found that direct Federal funding to address global climate change totaled approximately $77 billion between 2008 and 2013, 18 agencies involved. For this amount, the taxpayer should expect significant benefits. Yet the facts show that if the agenda is adopted in its entirety and all these goals are achieved in the U.S., there would still be no measurable difference in the global temperatures 20, 50 or 100 years from now.

What else is wrong with the climate agenda of the President? It empowers Federal bureaucrats to regulate in ways that Congress never authorized. I reject the notion that the 1970 Clean Air Act gave EPA the power to force every coal-fired power plant in America to capture and store carbon dioxide. Carbon dioxide was never even contemplated when the Clean Air Act was passed.

Moreover, the President continues to misrepresent climate science. He repeatedly stated global temperatures are increasing more than was predicted 10 years ago. I raised that before. This claim is demonstrably false. It is as false as, if you like your health insurance, you can keep it. Really worse, because it misrepresents existing facts, not something that might happen in the future.

As shown in this chart, which was updated just a few days ago, with the most recent satellite data for all of 2013, global temperatures have not increased since 1998. They just haven't. That is not consistent with the models that we have been told correctly predict our future. Even the State Department in a letter to me of December of this year acknowledged a "recent slowdown in atmospheric warming," they acknowledge that. But the President is still claiming it is higher than was predicted. That is not acceptable. We expect more out of the President and we expect the EPA director to tell the President, this is not accurate and to stop saying that.

Finally, the President's plan is doing too much too fast. Scientific American just this month had an article entitled The Long Slow Rise of Solar and Wind. They say that each widespread transition from one dominant fuel to the other has taken 50 to 60 years. And there is no technical or financial reason to believe renewables will rise any faster. Yet we are trying to force this beyond reason. They go into some length about that.

Madam Chair, thank you for having this hearing. These are important issues. We need to wrestle with it, and I think we can begin that today.

Senator BOXER. Thank you so much.

And there is dispute about what you said, and I will put some things into the record at the end of the hearing, and I will be happy to share them with you, Senator.

OK, so we're now going to go to Senator Carper.

OPENING STATEMENT OF HON. THOMAS R. CARPER, U.S. SENATOR FROM THE STATE OF DELAWARE

Senator CARPER. Thank you, Madam Chair.

For years I have been working with our colleagues here in Congress and the Administration, all kinds of stakeholder groups across the country to try to tackle one of the biggest challenges of our generation, that is climate change. I believe climate change exists and that we are living on borrowed time. The longer we wait to address this issue, the more damaging and expensive it becomes.

Before the recent recession, we had members of both parties, including myself, put forth legislative proposals that would grow our economy and provide for a safe climate. This was a time when our climate change debates focused on how we would grow our economy and clean our environment. It is not a novel idea, in the 1970s and 1990s, Republican Presidents and a majority of the members on both sides of the aisle supported, as you recall, the Clean Air Act and the Clean Air Act Amendments of 1990. These clean air protections protected our health but also allowed our economy to grow exponentially.

Unfortunately, in recent years we have seen a shift in the debate and have been unable to find common ground in climate legislation. Today our climate change debates are focused on the science instead of solutions. Our debates focus on backsliding clean air laws instead of improving them. Essentially, we are back to debating whether we can have a strong economy or a clean environment. History has shown that this is a false choice.

As Congress fights over what to do, our communities are feeling the first tastes of the harmful effects of climate change through record droughts and storms. Coastal communities like those in my own State of Delaware are especially vulnerable as oceans slowly rise and more extreme storms like Superstorm Sandy hit our coasts. These climate impacts are costing our country not just in lives impacted but in true economic costs. In fact, for the first time in history, the Government Accountability Office last year listed climate change as one of the biggest fiscal risks facing our country in their annual high risk reports, GAO.

Federal Emergency Management Agency alone obligated over $80 billion, $80 billion in Federal assistance for disasters declared during fiscal years 2004 through 2011. Despite the warnings and the reality, Congress remains gridlocked over this issue, while our impacted communities, our children and the rest of the world await our leadership. I don't think the world can wait much longer.

That is why I welcome the President's comprehensive climate action plan. I think it is a big step. And a big step, and a big look forward to hearing today what progress we have made to date, and what work remains.

At the end of the day, I still believe the best path forward to combat climate change is through legislation. I hope in the near future members of both parties, as well as leaders in the private sector and other stakeholders will decide to come together in a common sense environmental protections that are good for our climate, our health and our economy.

The last thing I would say, if I could, Administrator McCarthy and I were together on Monday of this week in Detroit, where GM won car of the year or truck of the year, international competition against the best of the world. We also saw unveiled a new updated F–150 truck, the top selling vehicle in America, the Ford F–150. They have taken 700 pounds out of the weight of the vehicle, Madam Chair, 700 pounds, and the EPA mileage of that truck, believe it or not, highway mileage is 30 miles per gallon. Thirty miles per gallon for an F–150. Who would have thunk it.

We saw internal combustion engines using turbo charges from Honeywell and other American companies that are getting 40, 45, 50 miles per gallon, internal combustion engines. Saw a clean diesel engine that is getting like 60 some miles per gallon, I think it was a Volkswagen Jetta. And I think a Mazda product that is getting 70 miles per gallon. A lot of folk who were talking about fuel, not just talking but they are working, spending money on fuel cells and on that particular approach to production and propulsion.

A lot of good stuff is happening, a lot of good stuff is happening. And part of it is because of the legislative work that we did on CAFE that basically said, these are going to the goals that we are setting, the milestones that we want to reach and by golly, we are reaching them. It is exciting, it is creating jobs, it cleans up the environment, it reduces our dependence on foreign oil and fossil fuels. But it is actually creating a stronger economy, not a weaker economy.

The last thing I would say, we have a new chairman of GM, new president, new CEO, whose name is Mary Barra. At the ceremony that Monday morning, GM announced car of the year, Corvette Sting Ray, truck of the year, Silverado, and they had a huge crush of people around Mary as she tried to leave the press conference. As she walked out, I shook hands with her and gave her my business card. On it I had written these words, Gina. I said "Proud Mary, keep on rolling." Proud Mary, keep on rolling. Because they are rolling, they are rolling. They are not rolling just to make more money, provide more jobs but actually to clean up our economy.

Thank you very much.

Senator BOXER. That is the win-win I see.

Senator Fischer.

OPENING STATEMENT OF HON. DEB FISCHER, U.S. SENATOR FROM THE STATE OF NEBRASKA

Senator FISCHER. Thank you, Madam Chairman and Ranking Member for holding the hearing today. I welcome and thank the witnesses for being here as well.

I am especially pleased that we do have four witnesses here from the Administration. Congressional oversight, especially over EPA as it rolls out rules that jeopardize the affordability and reliability of American energy, is critical. Americans are very uneasy about a plan being enacted via executive fiat and with what seems to be a total disregard for the costs associated with it. Owners of coal plants have announced that a total of over 55,000 megawatts of coal fueled generating capacity will be shut down by 2025. Of this total, EPA regulations have been cited as a factor in the closure of over 45,000 of those megawatts, 303 coal units in 33 States. The American Coalition for Clean Coal Energy conservatively estimates that these shutdowns will cause the loss of 17,000 jobs.

In 2012, National Economic Research Associates analyzed the impacts of several EPA regulations affecting coal fueled electricity generation. Compliance costs for the electric sector average $15 billion to $15.7 billion per year. U.S. employment losses average 544,000 to 887,000 per year. Given EPA's recent new source performance standard proposal, which hinges upon unproven carbon capture and sequestration technology, Americans can only expect even higher energy prices and greater job losses.

Countries that have made shifts away from fossil fuels are now finding such policy positions to be untenable. The New York Times reported last year, "Europe faces a crisis in energy costs. In Britain, climate changes and charges add 19 percent to the electricity prices that large manufacturers pay, steel production is down about 30 percent. Britain, where the average annual household energy bill has doubled since 2006, is approaching a tipping point where large numbers of people decide to switch off heat permanently.”

The Wall Street Journal reported “support for the European Union’s climate and energy policy eroded further Friday as the Czech Republic became the latest member to denounce subsidies for clean but costly renewable energy and pledged to double down on its use of fossil fuels. It followed Poland’s declaration that it would use its abundant domestic coal supplies for power generation rather than invest in costly renewable energy facilities. Spain abolished subsidies for photovoltaic power generation in July. And the U.K.’s power markets regulator last month froze solar power subsidies for the rest of the year.”

A headline in the Telegraph read “Brussels fears European industrial massacre sparked by energy costs.” In the article a European commissioner warned that Europe’s quixotic dash for renewables was pushing electricity costs to untenable levels. Likewise, Australia is learning tough lessons from its costly carbon tax. In the year after the carbon tax was introduced, household electricity prices rose 15 percent and the number of unemployed workers has risen by more than 10 percent. Meanwhile, Australia’s carbon dioxide emissions have actually increased and will continue to increase until 2043, according to their government.

I would urge us to heed these lessons and to proceed with caution before needlessly damaging our economy and adding to the burdens of our citizens. Thank you, Madam Chair, and I look forward to today’s testimony and questions.

Senator BOXER. Thank you, Senator Fischer.

Senator Boozman.

OPENING STATEMENT OF HON. JOHN BOOZMAN, U.S. SENATOR FROM THE STATE OF ARKANSAS

Senator BOOZMAN. Thank you, Madam Chair. And again, thank you for holding the hearing. I am glad that we are reviewing the President’s climate regulation plan. Oversight is a good thing and we appreciate you all being here. In fact, we need to have you up here more often discussing not only these issues but these really important problems that we face as a Nation.

Today the question is not whether greenhouse gases trap heat. They do. The question is whether current climate science and predict and adequately explain the complexity of climate change. Can it do it to the point that our politicians here in Washington can manipulate the earth’s temperature from their desks as we speak? Certainly their track record in that regard in the past has not been very good in a number of different things.

The question is also whether expensive regulations would have significant impact on the global climate and whether the President’s policies are worth lost jobs, lower take home pay, high gas and electricity prices, higher food prices and so on. Sadly, this plan appears to be all pain and no gain. The President once said that his climate policies would make the cost of electricity necessarily skyrocket. Now he says his plans won’t cost much. The President may promise that if you like affordable energy, you can keep affordable energy. But like his other promises, we know that that is simply not true. We hear many claims, but the actual climate is not doing what the models predicted. As one of our witnesses said last year, the models have not been successfully field tested for predicting climate change and so far, their error rate should preclude their use from predicting future climate change.

So what does all this mean? Let me explain it in my terms. I am an optometrist, my brother was an ophthalmologist, we had an eye clinic. When a patient's symptoms were complicated or unclear, we never pretended to be certain about a diagnosis. Instead, we would take a scientific approach and be thoughtful, ask questions, investigate. And we were honest with our patients. We would not prescribe a risky procedure if we were uncertain whether we would do more harm than good.

Climate change is similar. There is uncertainty. We see symptoms, but there is strong, contradictory evidence, there is broad consensus that carbon emissions have at least some impact on the climate, but we don't know how much. And beyond that, the consensus breaks down. So the diagnosis is unclear. The President's climate regulations are a series of risky procedures with potentially harmful consequences to treat a possible problem that we don't actually understand. So a scientific approach, despite what is being said, and being actually done, the actual scientific process is to be thoughtful, ask questions and investigate.

Sadly, those who raise legitimate questions are portrayed as "anti-science." But there is nothing scientific about discrediting conflicting evidence and asking reasonable questions. Political parties are not science referees, cutting off debate when it suits one side. In short, no political party has a monopoly on the facts.

Speaking of the facts, when reviewing proposed rules we must be honest about both the benefits and the costs. Sadly, the Administration recently disregarded well established OMB cost-benefit guidelines to generate an increased social cost of carbon. In other words, they broke the rules to make emissions look more costly. They cooked the books to meet their needs.

Instead of creating climate millionaires who benefit from carbon trading schemes and new regulations, let's remember that the pain falls hardest on low income families. These rules will drive industry costs, hurting American workers and creating foreign factories that emit far more than we would save. This climate plan can pass Congress, and I understand the temptation to ignore our system of checks and balances, pretend the Constitution doesn't exist and implement whatever plans the President would like. But that is not how representative democracy works. The rest of the world is retreating as we heard earlier. Instead, let's find common ground and let's encourage an all of the above energy mix including wind, renewable, biomass, hydro, solar, natural gas. We will continue to reduce carbon emissions. Nuclear power can produce vast quantities of emissions-free energy. Efficiency and new innovations offer great promise.

In short, regardless of whoever's views, we can all work together to reduce emissions without this job killing climate plan. Let's find that common ground. I very much look forward to your testimony. Thank you.

Senator BOXER. Thank you so much, Senator.

And last but not least, Senator Wicker.

OPENING STATEMENT OF HON. ROGER WICKER, U.S. SENATOR FROM THE STATE OF MISSISSIPPI

Senator WICKER. Thank you, Madam Chairman, and thank you to members of both panels. It is about to be your turn.

In Federalist Number 47, James Madison stated there can be no liberty where the legislative and executive powers are united in the same person or body of magistrates. I fear members of our current Administration are anointing themselves as both legislators and administrators with this climate action plan, and I hope we have a dialogue about that today and in the coming weeks.

I also hope we have a reasonable dialogue as Senator Boozman suggested on the science, on the different views, on the matter of climate science. And I hope we can discuss the various views in this room and in this country with respect. What is called for with regard to climate science is a robust and comprehensive dialogue. Already we have heard it suggested today by some of my friends on the other side of the aisle that to question the science of climate science amounts to scandal. I hope we can avoid that. This morning I hope we are able to engage in a productive exchange of our concerns about the President's plan, and about executive overreach and this agenda's effect on jobs. I think we should be able to talk openly about climate science issues, such as the link between climate change and human activity as well as the challenges of making long-term climate predictions based on models.

Now, here are some facts. According to analysis done by Dr. John Christy of the Earth System Science Center at the University of Alabama Huntsville, predictions made by 73 computer models cited by the United Nations latest Intergovernmental Panel on Climate Change, IPCC, Fifth Assessment Report, do not accurately predict the lack of temperature rises seen in the past 17 years. In other words, the IPCC models have been inaccurate. The past 15 years, recorded world temperatures have increased only a quarter of the rate IPCC claimed when it published its last assessment in 2007.

Further, the 2007 IPCC report included predictions of a decline in Antarctic sea ice. But the latest document does not explain why this year it is at a record high. Antarctic sea ice is at a record high.

In addition, the 2013 report states most models simulate a small decreasing trend in Antarctic sea ice extent in contrast to the small increasing trend in observations. The reality differs from the models.

The 2007 forecast for more intense hurricanes has also been ignored in the new document after this year was one of the quietest hurricane seasons in history. This from a leading group of international experts on climate science.

A recently published article in Science magazine entitled In the Hot Seat said the fact is there is little or no evidence that global warming steered Sandy into New Jersey or made the storm any stronger. And scientists haven't even tried yet to link climate change with particular fires.

Despite this knowledge, the Administration has based many policy decisions on the link between specific extreme weather events and climate change, as well as predictions on climate models. Climate modeling is difficult by nature, and there are large degrees of uncertainty in the resulting predictions. Anyone who suggests, as has been suggested in this room today, that climate science is not complicated, is simply being naive. Many of the President's policies will negatively affect our constituents by preventing them from earning a living. How can we expect to assure these people that their sacrifices will benefit them in the long term, when we do not have the capacity to accurately predict regional climate changes?

Again, these discussions are important and they should be had in this Congress without either side being accused of engaging in scandal. Thank you, Madam Chair.

Senator BOXER. Thank you.

Well, it is your turn, panel. I am sure that you were fascinated with all of our comments and mesmerized by them. But now it is your turn to mesmerize us.

So, Hon. Gina McCarthy, Administrator of the Environmental Protection Agency, please.

STATEMENT OF HON. REGINA McCARTHY, ADMINISTRATOR, U.S. ENVIRONMENTAL PROTECTION AGENCY

Ms. MCCARTHY. Thanks, Chairman Boxer, Ranking Member Vitter, members of the committee. First, let me thank you for the opportunity to come and testify before you today.

In June of last year, the President reaffirmed his commitment to reducing carbon pollution when he directed many Federal agencies, including the Environmental Protection Agency, to take meaningful steps to mitigate the current and future damage caused by carbon dioxide emission and to prepare for the anticipated climate changes that have already been set in motion.

Climate change is one of the greatest challenges of our time. Responding to this challenge is an urgent public health, safety, national security and environmental imperative that presents both an economic challenge and an economic opportunity. Both the economy and the environment must provide for current and future generations. We can and must embrace cutting carbon pollution as a spark for business innovation, job creation, clean energy and broad economic growth. The United States' success over the past 40 years makes clear that environmental protection and economic growth go hand in hand. The President's climate action plan directs Federal agencies to address climate change using existing executive authorities.

The plan has three pillars: cutting carbon pollution in America, preparing the country for the impacts of climate change, and leading international efforts to combat global climate change. EPA plays a critical role in implementing the plan's first pillar, which is cutting carbon pollution. Over the past 4 years, EPA has begun to address this task under the Clean Air Act. In 2009, EPA and the National Highway Traffic Safety Administration, along with the auto industry, the UAW and other stakeholders, worked together to set greenhouse gas and fuel economy standards for model year light duty vehicles 2012 to 2025. Over the life of these vehicles, the standards will save an estimated $1.7 trillion for consumers and businesses and cut America's oil consumption by 12 billion barrels, while reducing greenhouse gas emissions by 6 billion metric tons.

Building on that success, the President asked EPA to work with States, utilities and other key stakeholders to develop plans to reduce carbon pollution from both future and existing power plants. In March 2012, the EPA first proposed carbon pollution standards for future power plants. After receiving over 2.5 million comments, we made the decision to issue a new proposal based on this input and updated information.

In September 2013, the EPA announced its new proposal. The proposed standards would establish the first uniform national limits on carbon pollution from future power plants. They do not apply to existing power plants. The proposal set separate national limits for new natural gas-fired turbines and new coal-fired units. The rule provides flexibility to the operators of these units by allowing them to average their emissions over multiple years to meet a somewhat tighter standard.

The standards reflect a demonstrated performance of efficient lower carbon technologies that are currently being used today and that set the stage for continued public and private investment in these technologies. We look forward to robust engagement on that proposal.

And for existing power plants, we are engaged in an outreach to a broad group of stakeholders who can inform the development of the proposed guidelines which we expect to issue in June of this year. These guidelines will provide guidance to States which have the primary role in developing and implementing plans to address carbon pollution from the existing plants in their States. When we issue the proposed guidelines, the more formal public process will begin, providing an additional opportunity for stakeholders and the general public to provide input.

The climate action plan also calls for the development of a comprehensive interagency strategy to address emissions of methane as well as domestic action to reduce emissions of hydrofluorocarbons, or HFCs. EPA is working on these aspects of the President's plan as well.

The President's plan also calls for a broad array of actions to prepare for the impacts of climate change. EPA is incorporating research on climate impacts into the implementation of our existing programs and developing information and tools to help decision-makers better understand these impacts. EPA is also working closely with our Federal agency counterparts on several other aspects of building our national resilience.

Working closely with the State Department, EPA is also engaged in international discussions with our partners in other countries in reducing carbon pollution through an array of activities.

In conclusion, the President's climate plan provides a road map for Federal action to meet the pressing challenge of climate change, promoting clean energy solutions that capitalize on American innovation and drive economic growth. EPA looks forward to working with other Federal agencies and all stakeholders on these critical efforts.

Thank you again, and I look forward to answering your questions.

[The prepared statement of Ms. McCarthy follows:]

Opening Statement of Regina McCarthy
Administrator
U.S. Environmental Protection Agency

Hearing on the President's Climate Action Plan
Committee on Environment and Public Works
U.S. Senate
January 16, 2014

Chairman Boxer, Ranking Member Vitter, members of the Committee: Thank you for the opportunity to testify today.

In June of last year, the President reaffirmed his commitment to reducing carbon pollution when he directed many federal agencies, including the Environmental Protection Agency, to take meaningful steps to mitigate the current and future damage caused by carbon dioxide emissions and to prepare for the anticipated climate changes that have already been set in motion.

Climate change is one of the greatest challenges of our time. Based on the evidence, more than 97% of climate scientists[1] are convinced that human-caused climate change is occurring. If our changing climate goes unchecked, it will have devastating impacts on the United States and the planet. Reducing carbon pollution is critically important to the protection of Americans' health and the environment upon which our economy depends.

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[1] W. R. L. Anderegg, "Expert Credibility in Climate Change," Proceedings of the National Academy of Sciences Vol. 107 No. 27, 12107-12109 (21 June 2010); DOI: 10.1073/pnas.1003187107.
P. T. Doran & M. K. Zimmerman, "Examining the Scientific Consensus on Climate Change," Eos Transactions American Geophysical Union Vol. 90 Issue 3 (2009), 22; DOI: 10.1029/2009EO030002.
N. Oreskes, "Beyond the Ivory Tower: The Scientific Consensus on Climate Change," Science Vol. 306 no. 5702, p. 1686 (3 December 2004); DOI: 10.1126/science.1103618.

Responding to climate change is an urgent public health, safety, national security, and environmental imperative that presents an economic challenge and an economic opportunity. As the President has stated, both the economy and the environment must provide for current and future generations, and we can and must embrace cutting carbon pollution as a spark for business innovation, job creation, clean energy and broad economic growth. The United States' success over the past 40 years makes clear that environmental protection and economic growth go hand in hand.

The President's Climate Action Plan directs federal agencies to address climate change using existing executive authorities. The Plan has three key pillars: cutting carbon pollution in America; preparing the country for the impacts of climate change; and leading international efforts to combat global climate change.

Cutting Carbon Pollution

EPA plays a critical role in implementing the Plan's first pillar, cutting carbon pollution. Over the past four years, EPA has begun to address this task under the Clean Air Act.

Our first steps addressed motor vehicles, which annually emit nearly a third of U.S. carbon pollution. EPA and the National Highway Traffic Safety Administration, along with the auto industry and other stakeholders, worked together to set greenhouse gas and fuel economy standards for Model Year 2012 to 2025 light-duty vehicles. Over the life of these vehicles, the standards will save an estimated $1.7 trillion for consumers and businesses and cut America's oil consumption by 12 billion barrels, while reducing greenhouse gas emissions by 6 billion metric tons.

EPA's and NHTSA's standards for model year 2014 through 2018 heavy-duty trucks and buses present a similar success story. Under the President's Plan, we will be developing a second phase of heavy-duty vehicle standards for post 2018 model years.

Building on this success, the President asked EPA to work with states, utilities and other key stakeholders to develop plans to reduce carbon pollution from future and existing power plants.

Power plants are the single largest source of carbon pollution in the United States. In March 2012, the EPA first proposed carbon pollution standards for future power plants. After receiving over 2.5 million comments, we determined to issue a new proposed rule based on this input and updated information.

In September 2013, the EPA announced its new proposal. The proposed standards would establish the first uniform national limits on carbon pollution from future power plants. They will not apply to existing power plants. The proposal sets separate national limits for new natural gas-fired turbines and new coal-fired units. New large natural gas-fired turbines would need to emit less than 1,000 pounds of CO2 per megawatt-hour, while new small natural gas-fired turbines would need to emit less than 1,100 pounds of CO2 per megawatt-hour. New coal-fired units would need to emit less than 1,100 pounds of CO2 per megawatt-hour. Operators of these units could choose to have additional flexibility by averaging their emissions over multiple years to meet a somewhat tighter limit.

The standards reflect the demonstrated performance of efficient, lower carbon technologies that are currently being used today. They set the stage for continued public and private investment in technologies like efficient natural gas and carbon capture and storage. The proposal was recently published in the Federal Register on January 8, and the formal public comment period is now open. We look forward to robust engagement on the proposal and will carefully consider the comments and input we receive as a final rule is developed.

As noted, the proposed rule would apply only to future power plants. For existing plants, we are engaged in outreach to a broad group of stakeholders who can inform the development of proposed guidelines, which we expect to issue in June of this year. These guidelines will provide guidance to States, which have the primary role in developing and implementing plans to address carbon pollution from the existing plants in their states. We recognize that existing power plants require a distinct approach, and this framework will allow us to capitalize on state leadership and innovation while also accounting for regional diversity and providing flexibility.

The EPA's stakeholder outreach and public engagement in preparation for this rulemaking is extensive and vigorous. We held eleven public listening sessions around the country at EPA regional offices and our headquarters in Washington, DC. We have participated in numerous meetings with a broad range of stakeholders across the country. And all of this is happening well before we propose any guidelines. When we issue proposed guidelines in June, the more formal public process begins – including a public comment period and an opportunity for a public hearing – which will provide yet further opportunity for stakeholders and the general public to provide input.

Cutting Methane Emissions

The Climate Action Plan calls for the development of a comprehensive, interagency strategy to address emissions of methane, a powerful greenhouse gas that also contributes to ozone pollution, but which has substantial economic value. EPA is working with other agencies to assess emissions data, address data gaps, and identify opportunities to reduce methane emissions through incentive-based programs and existing authorities.

Curbing Emissions of HFCs

The Plan also calls on the US to lead through international diplomacy as well as domestic action to reduce emissions of hydrofluorocarbons (HFCs), potent greenhouse gases whose emissions are otherwise expected to nearly triple by 2030. Moving forward, the EPA will use its authority under the Clean Air Act to encourage the investment, purchase, and use of climate-friendly alternatives.

Preparing for Impacts of Climate Change

Even as we work to avoid dangerous climate change, we must strengthen America's resilience to climate impacts we're already experiencing and those that can no longer be avoided. The President's Plan calls for a broad array of actions on this front. EPA is incorporating research on climate impacts into the implementation of our existing programs and developing information and tools to help decision-makers – including State, local and tribal governments – to better understand and address these impacts. Further, EPA is working closely with our federal agency counterparts on several other aspects of building our national resilience, including developing the National Drought Resilience Partnership, ensuring the security of our freshwater supplies, protecting our water utilities, and protecting and restoring our natural resources in the face of a changing climate.

International Efforts

Our changing climate is also a global challenge, and the President's Plan recognizes that the United States must couple action at home with leadership abroad. Working closely with the State Department, EPA continues to engage our international partners in reducing carbon pollution through an array of activities. These include public-private partnership efforts to address emissions of methane and other short-lived climate pollutants under the Climate and Clean Air Coalition and the Global Methane Initiative, as well as bilateral cooperation with major economies.

Conclusion

The President's Plan provides a roadmap for federal action to meet the pressing challenge of a changing climate – promoting clean energy solutions that capitalize on American innovation and drive economic growth. EPA looks forward to working with other federal agencies and all stakeholders on these critical efforts.

Thank you again for the opportunity to testify, and I look forward to answering your questions.

Environment and Public Works Committee Hearing
January 16, 2014
Administrator Gina McCarthy
Follow-Up Questions for Written Submission

Senator Barbara Boxer

Senator Barbara Boxer

1. On December 7, 2009, the EPA made the finding (Endangerment Finding) that current and projected levels of greenhouse gases including, carbon dioxide (CO2) and methane threaten the public health and welfare of the nation's current and future generations. Could you please summarize the findings as it relates to the extreme weather, floods, drought and wildfires?

EPA specifically addressed how extreme events associated with climate change factored into the endangerment decision. With regard to how these extreme events factored into EPA's decision to make an endangerment finding for public health, the summary statement from the 2009 Endangerment Finding was the following: "The evidence concerning how human-induced climate change may alter extreme weather events also clearly supports a finding of endangerment, given the serious adverse impacts that can result from such events and the increase in risk, even if small, of the occurrence and intensity of events such as hurricanes and floods. Additionally, public health is expected to be adversely affected by an increase in the severity of coastal storm events due to rising sea levels." Regarding public welfare, the Endangerment Finding stated, "Across the sectors, the potential serious adverse impacts of extreme events, such as wildfires, flooding, drought, and extreme weather conditions, provide strong support for such a finding."

To take forestry as an example, the Endangerment Finding stated, "For the near term, the Administrator believes the beneficial impact on forest growth and productivity in certain parts of the country from climate change to be more than offset by the clear risk from the more significant and serious adverse effects from the observed increases in wildfires, combined with the adverse impacts on growth and productivity in other areas of the country and the serious risks from the spread of destructive pests and disease. Increased wildfires can also increase particulate matter and thus create public health concerns as well. For the longer term, the Administrator views the risk from adverse effects to increase over time, such that overall climate change presents serious adverse risks for forest productivity."

2. Could you please summarize the peer-reviewed science that served as the basis for the Endangerment Finding?

To inform its decision on endangerment, EPA primarily relied on the major peer-reviewed assessments of the National Research Council (of the National Academies of Science), the U.S. Global Change Research Program, and the Intergovernmental Panel on Climate Change. EPA viewed, and continues to view, these assessments as the best reference materials and the best available science. In addition, EPA reviewed numerous individual studies that were submitted to EPA as part of the public comment process, and EPA thoroughly responded to all comments associated with those studies throughout its 11 volumes of responses to comments, all of which are publically available on EPA's website.

3. Was the EPA use of peer-reviewed climate change science in the Endangerment Finding upheld by the U.S. Court of Appeals for the District of Columbia in the case *Coalition for Responsible Regulation v. EPA* (June 26, 2012)?

Yes. The U.S. Court of Appeals, in its June 26, 2012, decision upheld EPA's use of peer-reviewed scientific assessments as the basis for the Endangerment Finding. The Court of Appeals concluded the Endangerment Finding was "neither arbitrary nor capricious," that EPA "compiled a substantial scientific record," and that state and industry petitioners' objections to EPA's use and interpretation of "major scientific assessments" had no merit. The Court of Appeals described the assessments used by EPA as such: "These peer-reviewed assessments synthesized thousands of individual studies on various aspects of greenhouse gases and climate change and drew 'overarching conclusions' about the state of science in this field."

4. EPA has sought public comments on its proposed rules for new power plants. Is it correct that the agency received over 2.5 million public comments on the proposal?

EPA received more than 2.5 million public comments on the April 2012 proposal, and a large number of these comments were supportive of reducing carbon emissions from power plants. The EPA issued a new proposal in January 2014, and the comment period closed on May 9, 2014. EPA received more than 2 million public comments on the January 2014 proposal.

5. Is it correct that the vast majority of these comments supported EPA action to limit carbon pollution from power plants?

Yes, see answer to question 4.

6. The Climate Action Plan calls for using the Clean Air Act to set limits on carbon pollution from cars, trucks, and power plants. Are these actions supported by the Supreme Court decisions in Massachusetts v. EPA (2007) and American Electric Power v. Connecticut (2011), as well as more recent decisions from the U.S. Court of Appeals for the D.C. Circuit?

Yes, as well as the Supreme Court's recent decision in *Utility Air Regulatory Group v. EPA* (2014).

7. The Climate Action Plan calls for using the Clean Air Act to set limits on carbon pollution from cars, trucks, and power plants. Over the Clean Air Act's forty-plus year history what benefits has it provided to the nation's health and economy?

For more than 40 years, the Clean Air Act has fostered steady progress in reducing air pollution, allowing Americans to breathe easier and live healthier. A peer-reviewed 2011 EPA study estimated that, in 2010 alone, reductions in fine particle pollution and ozone pollution achieved by the Clean Air Act Amendments of 1990:[1]

- **Avoided more than 160,000 premature deaths, 130,000 heart attacks (acute myocardial infarction), millions of cases of respiratory problems such as acute bronchitis and asthma attacks, and 86,000 hospital admissions.**
- **Prevented 13 million lost workdays, improving worker productivity which contributes to a stronger economy.**

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[1] U.S. EPA, *The Benefits and Costs of the Clean Air Act from 1990 to 2020: Final Report*, Office of Air and Radiation, March 2011. This study is the third in a series of studies mandated by Congress in the Clean Air Act Amendments of 1990. The report received extensive review and input from the Council on Clean Air Compliance Analysis, an independent panel of distinguished economists, scientists and public health experts established by Congress in 1991. Report available at http://www.epa.gov/air/sect812/prospective2.html.

- **Kept kids healthy and in school, avoiding 3.2 million lost school days due to respiratory illness and other diseases caused or exacerbated by air pollution.**

Multiple peer-reviewed economic analyses suggest that the substantial public health benefits of the Clean Air Act are far greater than the costs of achieving them.[2]

1. **Most recently, EPA's peer-reviewed 2011 study found that clean air programs established by the 1990 CAA amendments are expected to yield direct benefits to the American people which vastly exceed compliance costs.**[3]
    - **The study's central benefits estimate in 2020 exceeds costs by a factor of more than 30-to-1, and the high benefits estimate exceeds costs by 90-to-1. Even the low benefits estimate exceeds costs by about 3-to-1.**
    - **In addition to direct benefits vastly exceeding direct costs, economy-wide modeling conducted for the study found that the economic welfare of American households is better with post-1990 clean air programs than without them.**
    - **Economic welfare and economic growth rates are improved because cleaner air means fewer air-pollution-related illnesses, which in turn means less money spent on medical treatments and lower absenteeism among American workers. The study projects that the beneficial economic effects of these two improvements alone more than offset the economic impacts from expenditures for pollution control.**
    - **The EPA report received extensive review and input from the Advisory Council on Clean Air Compliance Analysis, an independent panel of distinguished economists, scientists and public health experts established by Congress in 1991.**
2. **Another, earlier peer-reviewed EPA study examined the benefits and costs of Clean Air Act programs from 1970 to 1990, and also found that the public health protection and environmental benefits exceeded the costs by a large margin.**[4]

8. The Administration has already taken several steps to reduce carbon pollution. One of the biggest steps has been new fuel economy standards for cars and trucks. Could you please describe the consumer and climate change benefits of those rules?

EPA and the Department of Transportation (DOT) have jointly established a National Program of harmonized standards to address climate change and energy dependence, respectively setting standards to reduce greenhouse gases (GHGs) and improve fuel economy from light-duty passenger cars and trucks. These standards are projected to result in new vehicles achieving 163 g/mile of CO2 by 2025 (the equivalent of 54.5 mpg if achieved exclusively through fuel economy improvements) – which represents roughly a doubling of fuel economy since President Obama took office. The National Program ensures that auto manufacturers can build a single fleet of U.S. vehicles that satisfy requirements of both federal programs as well as California's program. The

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[2] See for example: U.S. EPA. *The Benefits and Costs of the Clean Air Act from 1990 to 2020: Final Report*, Office of Air and Radiation, March 2011; U.S. EPA, *The Benefits and Costs of the CAA 1990 to 2010: EPA Report to Congress*, Office of Air and Radiation, November 1999; U.S. EPA, *The Benefits and Costs of the CAA, 1970 to 1990: Prepared for U.S. Congress by U.S. Environmental Protection Agency*, October 1997.

[3] U.S. EPA, *The Benefits and Costs of the Clean Air Act from 1990 to 2020: Final Report*, Office of Air and Radiation, March 2011.

[4] U.S. EPA, *The Benefits and Costs of the CAA, 1970 to 1990: Prepared for U.S. Congress by U.S. Environmental Protection Agency*, October 1997. Report available at: http://www.epa.gov/air/sect812/retro.html.

standards also preserve consumer choice -- that is, the standards should not affect consumers' opportunity to purchase the size of vehicle with the performance, utility and safety features that meet their needs.

The benefits of this program are enormous. Together, the standards for model years 2012-2025 will save 12 billion barrels of oil and 6 billion metric tons of CO2 over the lifetime of those vehicles. Americans will save $1.7 trillion at the gas pump over the life of the program, and consumers who buy a new model year 2025 vehicle will save more than $8,000 in gasoline over that vehicle's lifetime.

9. Do other countries have standards requiring that new coal-fired power plants to capture carbon dioxide?

Yes. One clear example is Canada, which in 2012 set a performance standard for new coal-fired units that can be met by building coal generation with Carbon Capture and Storage (CCS). In addition to performance standards, many countries around the world are taking action to limit carbon pollution through a range of measures, including market-based programs and investments in clean generation.

Canada is also home to the world's largest fully-integrated commercial-scale CCS project of its kind—SaskPower's Boundary Dam. The Boundary Dam project, which began commercial operations in October 2014, fully integrates the rebuilt 110 MW coal-fired Unit #3 with available CCS technology to capture 90 percent of its CO2 emissions.

10. If so, do any of these standards require greater capture of carbon dioxide than the levels proposed by the EPA in its "Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units," 79 Fed. Reg. 1430 (Jan. 8, 2014)?

In the case of Canada, their performance standard is set at 420 metric tons per gigawatt hour. After putting the standards on a comparable basis, the Canadian standard is approximately 10% to 18% more stringent than the proposed U.S. standard.

11. In October 2013, the Global CCS Institute, whose membership includes American Electric Power, Arch Coal and Duke Energy, stated that "CCS technology is well understood and a reality." It also identified, as of September 2012, 75 large-scale integrated CCS projects with 16 of these projects currently operating or in construction and 59 in planning stages of development. Do these findings support a determination that that carbon capture and sequestration technology is a best system of emission reduction that has been adequately demonstrated?

The EPA has proposed to determine that CCS is technically feasible for new coal-fired power plants, because all of the major components of CCS – the capture, the transport, and the injection and storage – have been demonstrated and are currently in use at commercial scale. For example there are several industrial projects in the U.S. that are currently capturing the CO2 for use in enhanced oil recovery (EOR) or other applications. There have been numerous smaller-scale projects that have demonstrated the technology, and there are several full-scale projects – both in the U.S. and internationally – that are under construction today. Thus, the EPA has proposed to determine that partial CCS is the Best System of Emission Reduction (BSER) for new coal-fired power plants.

Senator Thomas R. Carper

1. Administrator McCarthy, I was quite happy with what was in the President's Climate Action Plan. However, I was surprised to see what was not included – support for domestic efforts to reduce black carbon. Recent studies have shown black carbon to be the second most damaging greenhouse agent behind carbon dioxide. These same studies have shown the most effective way to reduce black carbon is by cleaning up diesel emissions. Do you believe DERA and domestic clean diesel programs like Clean Construction should be part of our strategy to address climate here at home? If so, do you think we can expect more support from the Administration in future budgets?

The DERA program has been very successful. DERA averages more than $13 in health and economic benefits for every $1 in funding. Since 2008, Congress has appropriated more than $560 million for the DERA program, including $300 million as part of the American Recovery and Reinvestment Act of 2009. However, budget constraints mean we have to make tough choices. Ongoing projects will continue during FY 2015, as the agency continues to support and administer projects funded through the regular DERA program.

2. The EPA is scheduled to finalize standards for cooling water intake structures under section 316(b) of the Clean Water Act by January 28, 2014. What steps have been taken to ensure the best science available has been used to determine both the costs and benefits to justify the new standards?

The EPA agrees that it was important that its final standards for cooling water intake structures under Section 316(b) of the Clean Water Act be informed by the best-available science and information regarding costs and benefits. For the Section 316(b) rulemaking, benefits include the protection of fish and other aquatic organisms, while costs include the potential expense to covered facilities to comply with the rule. The agency's final rule was signed on May 19, 2014, and published in the Federal Register on August 15, 2014. The agency performed a benefit-cost analysis of its regulation, which was made available to the public at the time the final rule was published in the Federal Register.

3. In 2013, 4 of our nation's 104 nuclear power reactors permanently shutdown and one more is scheduled to retire by the end of 2014. We may see more closures this year. What are the assumptions in the President's Climate Action Plan about the base load generation of electricity through nuclear power in order to meet climate and carbon emission goals? What will the impact of these 5 plant closures be on the President's climate and carbon emission goals? What will the impact of more nuclear power reactor closures, if any, be on those goals?

The 2014 U.S. Climate Action Report to the UNFCCC includes projections of U.S. GHG emissions under current policies and measures, and potential reductions from additional measures consistent with the President's Climate Action Plan. The scenario describing projections of emissions under policies and measures already in place was based on the 2013 Annual Energy Outlook published by Energy Information Administration. Since then, EIA has published the 2014 Annual Energy Outlook full report, which has updated information on nuclear power generation. Generation from nuclear power in AEO2014 is 12% below levels in AEO2013 in 2020, but due to other changes, emissions from the electric power sector are less than 2% above levels in AEO2013 in 2020. The following table summarizes the data from AEO2013 and the AEO2014.

	AEO2013	AEO2014
Nuclear generation capacity in 2020 (Gigawatts)	110.6	97.8
Nuclear electricity produced (billion kwh)	885	779

CO2 emissions from the electricity sector (TgCO2e)	2081	2112
Total CO2 emissions (TgCO2e)	5455	5476

Senator David Vitter

1. How much has your agency spent on climate change-related activities, including those in furtherance of the Climate Action Plan, since 2008?

The following table contains a summation of total dollars (both pay and non-pay) that support multiple EPA programs focusing on addressing the issue of climate change.

EPA Climate Change Funding ($000s)	FY 2008 Enacted	FY 2009 Enacted	FY 2010 Enacted	FY 2011 Enacted	FY 2012 Enacted	FY 2013 Enacted	FY 2014 Enacted
EPA	126,315	127,404	192,398	177,248	$168,418	$154,491	$158,784

2. According to EPA, an apparent benefit of the proposed rule is that the new source rule will serve as a "necessary predicate" for a power plant existing source rule under section 111(d). As EPA notes, under section 111, Congress prohibited EPA from issuing an existing source rule for a pollutant under section 111(d) unless it had first issued a new source rule under section 111(b) for that pollutant. Do you think issuing a "pro forma" new source rule that does nothing except pave the way for an existing source rule circumvents Congressional intent, and renders the new source rule predicate added to the statute meaningless?

EPA is proposing requirements for these sources because fossil fuel-fired power plants are the country's largest stationary source emitters of GHGs. These actions are consistent with the Climate Action Plan announced by the President in June 2013 to cut the carbon pollution that causes climate change and affects public health.

3. The Office of Management and Budget, during its review of EPA's re-proposed New Source Performance Standards for Power Plants, questioned EPA's assertion of the technical feasibility of carbon capture because EPA's determination that carbon capture and storage is adequately demonstrated as the best system of emissions reduction "relies heavily on literature reviews, pilot projects, and commercial facilities yet to operate." OMB also asserted that they believed "this cannot form the basis of a finding that CCS on commercial-scale power plants is 'adequately demonstrated.'" OMB also requested details of the specific CCS operations already in service that process the rate of CO_2 necessary for a typical IGCC power plant to be in compliance.

   a. What examples did EPA explicitly provide?

   The EPA shared the same information with OMB that we have shared with the general public through the preamble of the proposed rule and the accompanying Technical Support Documents.

4. You've said that hydraulic fracturing can be done safely and have agreed with former EPA Administrator Lisa Jackson that there have been no confirmed cases of hydraulic fracturing impacting drinking water. Given that the President's Climate Action Plan relies heavily on the use of natural gas, what is your vision for getting the American public to understand that hydraulic fracturing is safe and that fracking has unlocked an American energy revolution that is lowering all Americans' energy prices, creating jobs, helping to lower GHG emissions, and revitalizing such industries as the manufacturing, steel, and chemical sectors?

Responsible development of America's shale gas resources offers important economic, energy security, and environmental benefits. Recognizing this, in April 2012, President Obama signed

E.O. 13605, Supporting Safe and Responsible Development of Unconventional Domestic Natural Gas Resources, which, among other things, charges federal agencies to pursue multidisciplinary, coordinated research. The EPA is working with other federal agencies, states, and other stakeholders to understand and address potential concerns with hydraulic fracturing so the public has confidence that natural gas production will proceed in a safe and responsible manner. The EPA continues to move forward on our national research study on the potential impacts of hydraulic fracturing for oil and gas on drinking water resources in response to a request from Congress. The study scope was designed to meet Congress' request and was established in November 2011 in the Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources, after public comment and peer review by the Science Advisory Board. The scope has not changed since the release of the final study plan.

5. EPA has addressed GHG emissions from the refining industry through fuel economy standards and through the GHG Tailoring Rule for larger projects. The refining industry accounts for only 3% to 6% of the total U.S. GHG emissions from industry. The refining industry already has the incentive to control energy: energy accounts for up to 50% of a refinery's controllable costs. Because the refining industry is already highly efficient, EPA analysis indicates that there is no opportunity for any significant reductions in this sector. Why is EPA putting efforts into regulating already highly efficient industries?

The EPA is not currently developing national standards to specifically regulate greenhouse gas (GHG) emissions from U.S. petroleum refineries. The EPA is continuing to study the issue of greenhouse gas (GHG) emissions from U.S. petroleum refineries. As part of other ongoing rulemaking actions we anticipate notable GHG co-benefit reductions. For example, rulemaking actions targeted at criteria pollutant and toxic pollutant reductions, specifically our new source performance standard and maximum achievable control technology programs, will likely produce notable co-benefit reductions. In addition, while EPA and the National Highway Traffic Safety Administration (NHTSA) are working to reduce GHG emissions and improve fuel economy of vehicles, this work does not ensure that refineries operate in an efficient manner.

6. What is the status of EPA's response to Industry's Freedom of Information request filed on August 20, 2013, with respect to the Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866?

The EPA fulfilled this request and provided responsive materials to the requestor on October 16, 2014.

7. The second proposal of the GHG NSPS for new power plants does not address the Energy Policy Act of 2005 (EPAct) or the potential limitations it imposes on EPA's "Best System of Emission Reduction" analysis. What is EPA's position on the fact that EPAct prohibits EPA from considering technology used at a facility receiving assistance under the Department of Energy's Clean Coal Power Initiative, or at a facility that is receiving an advanced coal project tax credit, as being "adequately demonstrated" for purposes of Section 111 of the Clean Air Act?

EPA does not believe that these provisions impact its determination. The EPA issued a Notice of Data Availability (NODA) that notes the availability of a Technical Support Document (TSD) in the rulemaking docket that details its position on this issue. It explains, "EPA interprets these provisions to preclude EPA from relying solely on the experience of facilities that received EPAct05 assistance, but not to preclude EPA from relying on the experience of such facilities in conjunction with other information." EPA based its determination on a number of projects and other

information including projects that did not receive any assistance under the Energy Policy Act of 2005. In addition, the agency extended the public comment period for the proposal by 60 days to allow adequate time for the public to review and comment on the contents of the NODA and TSD.

8. Under the language of Section 111(d) of the Clean Air Act, EPA establishes a procedure under which states submit to the EPA a plan that contains standards of performance for existing stationary sources.

    a. Does EPA agree that the states, not EPA, have the authority to establish "standards of performance" for existing stationary sources?

    b. Does EPA agree that any carbon dioxide emissions standards for existing power plants should be achievable at existing power plants?

Under EPA's long-standing regulations implementing Section 111(D) of the Clean Air Act, it is the responsibility of the Administrator to determine the Best System of Emissions Reduction that has been adequately demonstrated.

Under the statute, the term "standard of performance" means a "standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated." EPA explored all options available for achieving cost effective standards of performance by analyzing, among other things, results from the extensive outreach to states, industry, and other stakeholders we conducted prior to issuing the proposed Clean Power Plan on June 2, 2014.

9. In a document entitled "Questions for State Partners" issued by EPA in September 2013, EPA surveyed States about their experiences with "...emissions budget trading programs, resource planning requirements, end-use energy, efficiency resource standards, renewable energy portfolio standards, and appliance and building code energy standards..." This document suggests that EPA plans to decide what is achievable at existing electricity generating units by looking "outside the fence" to these types of activities. Can you confirm that EPA will not go "outside the fence" when deciding what is "achievable" by exiting power plants? Yes or no?

Section 111 (d) of the Clean Air Act is a state-based program for existing sources. The EPA establishes guidelines that give states the flexibility to design programs that fit in those guidelines to get the needed emissions reductions. We issued the proposed Clean Power Plan on June 2, 2014, and it was published in the Federal Register on June 18, 2014. The Clean Power Plan has two main parts: state-specific goals to lower carbon pollution from power plants and guidelines to help the states develop their plans for meeting the goals. The goal is a target states have to meet by 2030, while starting to make meaningful progress toward reductions by 2020. States develop plans to meet their goals, but EPA is not prescribing a specific set of measures for states to put in their plans. This gives states flexibility. States will choose what measures, actions, and requirements to include in their plans, and demonstrate how these will result in the needed reductions.

The Clean Power Plan will put in place a consistent national framework that builds on work states are already doing to reduce carbon pollution – especially through programs that encourage

renewable energy or energy efficiency. It will reduce carbon pollution from existing power plants while ensuring a reliable and affordable supply of power.

States will have fifteen years from when the rule is final until compliance with the final target, time in which to plan for and achieve reductions in carbon pollution.

10. Last fall, 17 State Attorneys General and one Senior Environmental Regulator sent you a white paper. The AGs raised concerns that EPA will not properly defer to States in establishing and implementing standards for existing power plants, and that under the guise of "flexibility," EPA will require existing power plants to operate less or shut down. Can you provide any assurances that, in its GHG regulation of existing plants, EPA will not force the retirement or reduced operation of still-viable coal-fired power plants?

Section 111 (d) of the Clean Air Act is a state-based program for existing sources. The EPA establishes guidelines that give states the flexibility to design programs that fit in those guidelines to get the needed emissions reductions. We issued the proposed Clean Power Plan on June 2, 2014, and it was published in the Federal Register on June 18, 2014. The Clean Power Plan has two main parts: state-specific goals to lower carbon pollution from power plants and guidelines to help the states develop their plans for meeting the goals. The goal is a target states have to meet by 2030, while starting to make meaningful progress toward reductions by 2020. States develop plans to meet their goals, but EPA is not prescribing a specific set of measures for states to put in their plans. This gives states flexibility. States will choose what measures, actions, and requirements to include in their plans, and demonstrate how these will result in the needed reductions. This allows them to consider local factors, including the impact of retirements, when they set their plans.

11. EPA is running point on the 316(b) proposal. This rule, as it was proposed, would affect a staggering 600 facilities across the country. I'm concerned about the cross-agency coordination, considering all of the agencies that are now involved. Are you concerned at all that these ESA negotiations could actually result in a de facto mandate to install cooling towers on power plants and manufacturers who use waters to cool their facilities?

EPA's 316(b) final rule was signed on May 19, 2014. Prior to that date, the rule was the subject of an interagency review coordinated by the Office of Management and Budget. Because this rule affects manufacturing and electric generating facilities, a significant number of federal agencies were involved in that review. At the same time, EPA was also in the midst of consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service ("the Services"), under section 7 of the Endangered Species Act. After careful consideration of multiple factors, EPA concluded that closed cycle cooling is not the "best technology available" for existing units.

12. Several provisions in EPA's proposed 316(b) cooling water intake rule could lead to a requirement to install cooling towers. These include (1) a requirement for modified units, including nuclear upgrades or replacements of turbines and condensers, to install cooling towers similar to EPA's New Source Review program under the Clean Air Act, (2) a requirement to use "willingness-to-pay" surveys to measure benefits that would significantly overstate benefits and possibly justify a decision to install towers; (3) a change in the status of cooling ponds and impoundments long considered to be closed-cycle cooling; and (4) overly broad Endangered Species Act provisions that could require facilities to cease operation or install cooling towers if a threatened or endangered species is located in a water body from which a facility draws water even without evidence of impact to that species. Facilities faced with a requirement to install cooling towers would likely retire rather than retrofit. This is especially true for nuclear units, many of which are unprofitable today as a result of

low demand, low natural gas prices and subsidized renewable generation. Have you considered the effect of retirements of nuclear units on grid reliability and climate change goals as a result of the 316(b) rulemaking?

As we did at proposal, EPA analyzed the possibility that plants would close due to increased costs of compliance with the final rule; this analysis is not confined to just nuclear power plants. After careful consideration of multiple factors, EPA concluded in the final rule that closed cycle cooling is not the "best technology available" for existing units. The final rule addresses site-specific challenges and establishes a common-sense framework that provides flexibility for facilities to comply.

13. We believe the Services should conclude the rule is "not likely to adversely affect" T&E species. We agree with EPA's original finding that the rule does not authorize any actions that could potentially harm T&E species because the rule provides additional protections for species from impingement and entrainment at cooling water intake structures. What steps are EPA taking to ensure that its original finding will prevail in the final rule? What organizations within the Administration are contesting that finding and on what basis?

On May 19, 2014, the EPA and the Services concluded their consultation under section 7 of the ESA. The Services final biological opinion concluded that EPA's rule is not likely to jeopardize the continued existence of ESA-listed species and is not likely to destroy or adversely modify designated critical habitat. EPA and the Services also have a memorandum of agreement (66 FR 11202, February 22, 2001) concerning coordination between EPA and the Services for conducting EPA's Clean Water Act programs, such as promulgation and approval of water quality standards and states' permitting programs.

14. Any ESA monitoring and study requirements must be focused on T&E species directly affected by the intake through entrainment or impingement. We understand that the proposed ESA provisions in 316(b) will require permittees to identify listed species that *may* be in the waterbodies from which a facility draws water and *might be* indirectly affected by intake structures. How does such an approach comport with the Endangered Species Act or the Clean Water or 40 years of precedent?

On May 19, 2014, the EPA and the Services concluded their consultation under section 7 of the ESA. The consultation concerned the "action area" where the "action" is EPA's final regulations on cooling water intake structures at existing facilities. In their ESA regulations (at 50 CFR 402.02), the Services have defined "action area" to mean "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action."

15. The approach proposed to be used to incorporate proposed ESA provisions into the state 316(b) permitting process represents a dramatic departure from the current NRC-initiated Section 7 consultations procedure used for nuclear facilities that involves multiple federal agencies. Having the ESA consultation take place prior to submittal of a state permit application would shift the decision-making to a single federal agency. Rather, any ESA study or consultation should occur as an integral part of the current permitting process and not separately. What are your thoughts on this?

Your question is about one of the issues that EPA and the Services discussed in the section 7 consultation under the ESA, which concluded on May 19, 2014. As described above, EPA and the Services have a memorandum of agreement concerning coordination between EPA and the

Services for conducting EPA's Clean Water Act programs. The final rule requires permitting authorities to send a copy of the permit application to the Services upon receipt, and to issue a draft permit only after 60 days have passed, to give the Services an opportunity to provide input. EPA's NPDES regulations already require the draft permit to be sent to the Services. Thus, the Services' input is part of the current permitting process. Nothing in EPA's rule changes the obligations of facilities that already comply with the ESA.

16. On June 25, 2012, the San Miguel Electric Cooperative submitted comments on the original proposed Greenhouse Gas New Source Performance Standards.[5] Those comments explicitly warned that the Energy Policy Act of 2005 ("EPAct") prohibits EPA from considering technology funded by the Clean Coal Power Initiative in analysis under § 111 of the Clean Air Act. Three months later, when introducing Re-proposed GHG NSPS on September 20, 2012, you referred to comments submitted to the original proposal saying, "We did what democracy demands. We paid attention. We read those comments. We thought about them. And we decided that we needed to update the proposal." However, you recently testified to the Committee that you were unaware of the EPAct prohibitions noted in the San Miguel comments at the time you made that statement.

    a. Were any Agency employees involved in drafting the Re-Proposed GHG NSPS aware of the EPAct prohibitions when the rule was issued on September 20, 2012?

    b. When was the first time Agency employees involved in drafting the Re-Proposed GHG NSPS discussed the EPAct prohibitions?

EPA does not believe that these provisions impact its determination. The EPA issued a Notice of Data Availability (NODA) that notes the availability of a Technical Support Document (TSD) in the rulemaking docket that details its position on this issue. It explains, "EPA interprets these provisions to preclude EPA from relying solely on the experience of facilities that received EPAct05 assistance, but not to preclude EPA from relying on the experience of such facilities in conjunction with other information." EPA based its determination on a number of projects and other information including projects that did not receive any assistance under the Energy Policy Act of 2005. In addition, the agency extended the public comment period for the proposal by 60 days to allow adequate time for the public to review and comment on the contents of the NODA and TSD.

17. According to the Re-proposed GHG NSPS, "DOE/NETL has prepared other reports—in particular their 'Cost and Performance Baseline' reports, including one on partial capture — that further support our proposed determination of the technical feasibility of partial capture." However, the DOE/NETL cost and performance baseline for partial capture includes a 20% "process contingency" to account for the fact that pre-combustion and post-combustion carbon capture is "unproven technology at commercial scale" for power plant applications. Please explain how

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[5] Euitizi, Joseph, *Comments on the Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, Proposed Rule, 77 Fed. Reg. 22392*, SAN MIGUEL ELEC. COOP., Docket No. EPA-HQ-OAR-2011-0660-9964, Jun. 25, 2012 (citing EPAct §402(i) and saying "The Clean Coal Power Initiative . . . was created by the Energy Policy Act of 2005 . . . to provide hundreds of millions of dollars of federal funding to clean coal projects. However, understanding that technologies developed under this act would not be commercially available, Congress included limitations on using these technologies as part of NSPS or other CAA reviews . . . .") (emphasis in original)).

modeling that assumes that CCS is unproven technology for commercial-scale power plants supports finding CCS to be proven technology for commercial-scale power plants.

The EPA has proposed to determine that CCS is technically feasible for new coal-fired power plants because all of the major components of CCS – the capture, the transport, and the injection and storage – have been demonstrated and are currently in use at commercial scale. For example there are several industrial projects in the U.S. that are currently capturing the CO2 for use in enhanced oil recovery (EOR) or other applications. There have been numerous smaller-scale projects that have demonstrated the technology, and there are several full-scale projects – both in the U.S. and internationally – that are under construction today. Thus, the EPA has proposed to determine that partial CCS is the Best System of Emission Reduction (BSER) for new coal-fired power plants.

18. On December 19, EPA issued a draft guidance on EOR operations, "Draft Underground Injection Control Program Guidance on Transitioning Class II Wells to Class VI Wells." that suggests if the business model for a well or group of wells changes from enhanced recovery to permanent carbon storage, the wells may need to be re-permitted as Class VI wells.

    a. Did EPA consider the cost of re-permitting and converting these wells in the proposed GHG rule?

    b. Isn't it true the CO2 injection in EOR applications is the only possible scenario that is at all economical?

The proposed carbon pollution standards for new power plants do not change any of the requirements to obtain or comply with an Underground Injection Control (UIC) permit for facilities that are subject to EPA's UIC program under the Safe Drinking Water Act.

The EPA has proposed to determine that CCS is technically feasible for new coal-fired power plants because all of the major components of CCS – the capture, the transport, and the injection and storage – have been demonstrated and are currently in use at commercial scale. Facilities using carbon capture are doing different things with the captured CO2, ranging from EOR to storage to using it for food products. While it is true that selling captured CO2 for EOR can generate revenue and help offset the costs of capturing carbon, this does not mean power plants built in the future will have to use EOR – nor does this proposal require it.

19. Stringent regulations in the U.S. will also increase the likelihood that energy intensive industries will build in other countries with fewer environmental controls. How are you addressing the problem of carbon leakage to make sure these regulations do not in fact increase global GHG emissions?

The Clean Air Act directs the EPA to set performance standards that represent the "best system of emission reduction…adequately demonstrated," including, among other factors, costs.

20. I, along with others, sent three letters to EPA regarding the Agency's involvement in the development of the SCC estimates, including the Agency's participation in the Interagency Working Group. Your Director Atmospheric Programs testified that staff from that office participated in the IWG, assisting particularly in respect to the technical work and the modeling.

a. Did you participate in any meetings of the IWG?

b. Did any of your direct reports participate in or attend any of the meetings?

c. Did you sign off on or approve any materials, technical analysis, or assistance that was provided by the Agency to the IWG?

d. Are the models relied upon in developing the Social Cost of Carbon estimates published and available on EPA's website?

e. Is the technical work and modeling conducted by EPA's Office of Atmospheric Programs for the IWG in the development of the SCC estimates publicly available including on EPA's website?

f. Which of your Agency's offices participated, including the number of staff, hours, and other resources dedicated to such work, as well as any outside experts or consultants that provided input or comments?

I did not participate in any meetings of the IWG. The Office of the Administrator reviewed materials that EPA provided to the IWG. My role as Administrator did not begin until after the release of the updated SCC estimates in 2013.

The integrated assessment models used to develop the USG SCC estimates are documented within the peer reviewed literature and source code is available on the model developers' websites or upon request from the relevant developer. Each model is also described in detail in the 2010 and 2013 Technical Support Documents (TSD) available on OMB's website.

The 2010 TSD for the USG SCC estimates provides the documentation of the interagency decisions and the 2013 TSD documents the technical update. Both are available on OMB's website. The 2010 and 2013 TSDs provide a step-by-step description of the modeling exercise and also provide exhaustive documentation of how the USG's review identified, evaluated, and adopted the data, assumptions, and analytical framework used to develop the SCC estimates. Furthermore, consistent with the Administration's commitment to transparency, EPA has, upon request, provided to researchers and institutions more detailed output than is presented in the 2010 or 2013 TSD, as well as instructions, input files, and model source code.

EPA staff (economists and climate scientists) from the National Center for Environmental Economics in EPA's Office of Policy and the Office of Atmospheric Programs (within EPA's Office of Air and Radiation) provided technical expertise in climate science and economics to the workgroup as needed.

21. The interagency working group decided to focus on the *global* social cost of carbon even though OMB Circular A-4 requires the regulatory impact analyses to include an analysis of *domestic* costs and benefits, leaving international analysis optional.

    a. What is the difference between the global and U.S.-only [domestic] social cost of carbon?

    b. How will you balance domestic versus global estimates of the social cost of carbon in making decisions?

c. Why doesn't the SCC only address the domestic cost as required by OMB?

EPA works with OMB to ensure that EPA is following guidance in assessing the costs and benefits of their agency actions. The use of a global value for the SCC is consistent with OMB guidance. As explained in the 2010 TSD, a global measure of SCC is appropriate in this context because emissions of greenhouse gases contribute to damages around the world and the world's economies are now highly interconnected. To reflect the global nature of the problem, the USG SCC estimates incorporate the full damages caused by carbon dioxide emissions and we expect other governments to consider the global consequences of their greenhouse gas emissions when setting their own domestic policies.

Senator James Inhofe

1. Ms. McCarthy, during your tenure at the EPA, has the Agency ever produced an estimate of the job losses that would be sustained across the entire economy as a result of a new regulation?

President Obama's Executive Order 13563 requires executive branch agencies to consider the effect of regulations on jobs. EPA is very concerned about the economic impacts, including the job impacts, of our regulations. That is why the EPA has been including an assessment of job impacts for all of its economically significant regulations.

Some business groups claimed that the Clean Air Act Amendments of 1990 themselves would cost at least 200,000 and up to two million jobs.[6] In contrast to doomsday predictions, history has shown, again and again, that we can clean up pollution, create jobs, and grow our economy all at the same time. Since 1970, air pollution has declined 72% while the economy has grown 219%.[7] Many of the industry-funded models that predict large job losses fail to include the jobs created through the investment in pollution reduction, pollution controls, and the benefits to public health and productivity. Overall, the peer-reviewed literature does not contain evidence that environmental regulation has a large impact on net employment (either negative or positive) in the long run across the whole economy.

Working with Senator Vitter, the EPA has agreed to convene a new EPA Science Advisory Board panel to advise EPA on how to conduct economy wide modeling, including assessment of employment impacts, of regulations. EPA issued a draft charge and analytic blueprint for this committee for public comment, and solicited nominations from the public for candidates to serve on the committee. We look forward to getting the further substantive input on how to advance our work on modeling the economic effects of air pollution reduction programs.

2. With respect to the EPA's New Source Performance Standards for electric generation units, did OMB, the Department of Energy, or any other agency in the federal government raise any concern or question that the rule's requirement to use Carbon Capture Sequestration technology may not yet be commercially demonstrated?

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[6] Hahn, Robert, and Wilbur Steger (1990). An Analysis of Jobs at Risk and Job Losses from the Proposed Clean Air Act Amendments (Pittsburgh: CONSAD Research Corporation).

[7] EPA, Our Nation's Air – Status and Trends through 2008 (Feb 2010).

The U.S. Department of Energy (DOE) was part of the interagency review process, which was coordinated by the Office of Management and Budget (OMB). Interagency comments on the draft proposal are available in the docket.

Senator John Barrasso

1. A Bloomberg News story ran entitled "EPA Assertions on Carbon Capture Viability Sparked Concerns by White House Officials." The article, which ran on January 10, 2014, quotes from interagency comments prepared by the White House Office of Management and Budget. The article quotes the White House OMB as saying about your new rule that–

> "EPA's assertion of the technical feasibility of carbon capture relies heavily on literature reviews, pilot projects, and commercial facilities yet to operate. We believe this cannot form the basis of a finding that CCS on commercial-scale power plants is 'adequately demonstrated.'"

As stated before, the law requires that emission control performance standards must be "adequately demonstrated." The White House is clearly saying that CCS is not adequately demonstrated.

What does the White House know that you haven't acknowledged and is the agency going to speak more definitively on this topic? If so, when?

The Office of Management and Budget coordinated interagency review of the draft proposal. Interagency comments and communications on the draft proposal are available in the docket.

The EPA has proposed that partial CCS is technically feasible for new coal-fired power plants because all of the major components of CCS – the capture, the transport, and the injection and storage – have been demonstrated and are currently in use at commercial scale. For example there are several industrial projects in the U.S. that are currently capturing the CO_2 for use in enhanced oil recovery (EOR) or other applications. There have been numerous smaller-scale projects that have demonstrated the technology, and there are several full-scale projects – both in the U.S. and internationally – that are under construction today. The information that the EPA relied on to make this determination is available in the preamble for the rule and the technical support document (TSD) available at this link: http://www2.epa.gov/sites/production/files/2014-01/documents/2013_proposed_cps_for_new_power_plants_tsd.pdf. Thus, the EPA has proposed to determine that partial CCS is the Best System of Emission Reduction (BSER) for new coal-fired power plants.

The EPA has received more than 2 million comments on this proposal and is reviewing and considering those as we work toward a final rule.

Senator Jeff Sessions

1. I have received many letters from constituents who are deeply troubled by the unwarranted, burdensome aspects of the President's climate agenda. A few examples are provided below, along with questions for you to answer specifically.

    a. **Jerry in Birmingham, Alabama** wrote: "I would like to know how [President] Obama and the EPA can pass laws that are closing the coal industry. There is no consideration about the impact on the middle class and our energy program. I thought Congress passed laws because each person in Congress represents the people in his district/state. We can't have one person setting regulations ..."

    Please explain how, in your view, Congress has expressly authorized the Environmental Protection Agency to regulate carbon dioxide released from the combustion of coal and natural gas in electric generating units.

    b. **Leslie in Gardendale, Alabama** wrote: "The President is talking about helping the middle class yet his policies and laws are hurting the middle class by destroying middle class jobs related to the coal industry... The company I work for had 50 employees when the President took office and today we have 28." Similarly, **Steve in Winfield, Alabama** wrote: "If we really want to grow the economy and create good paying jobs, then why would we do anything to make coal more costly to mine and use? The main areas where coal mines are operating are areas that would be economically devastated if coal mining were non-existent. These areas have a blue collar work force ..."

    Please explain your best estimate of the number of coal sector jobs that would be impacted by the portions of the President's climate plan that EPA intends to implement.

    c. **Keith in Fayette, Alabama** wrote: "With the Obama Administration's all-out war on coal, he is killing hundreds of thousands of jobs both directly and indirectly nationwide...This is a rare issue that touches every single person living in our state."

    Please list every regulation proposed and/or finalized by EPA since January 21, 2009 that is likely to have an adverse impact on coal sector jobs in the United States.

The Supreme Court made clear in *Massachusetts v. EPA* and subsequent decisions that greenhouse gases are a pollutant under the Clean Air Act. The EPA is setting standards, under section 111 of the Clean Air Act, to reduce carbon pollution and protect the public health and welfare. Executive Order 13563 requires executive branch agencies to consider the effect of regulations on jobs. We are mindful of the economic effects, including job effects, of our regulations. That is why the EPA has been including an assessment of job impacts for all of its economically significant regulations.

2. Has EPA fully analyzed the economic impact of the President's Climate Action Plan, taking into account the "whole economy"? If so, can you give me a copy of that report? Has EPA fully analyzed the specific impact of the President's plan on blue collar, middle class jobs?

There are several actions in the President's Climate Action Plan that will require several U.S. government agencies to develop recommendations, propose new rules, augment existing

activities, and undertake processes that entail significant stakeholder outreach and public comment before final rules and programs are in place. Although the purpose of each action is clear, the specific details of each will be developed over time.

The EPA has been including an assessment of job impacts for all of its economically significant regulations.

3. I am informed that, according to a recent study, Alabama families spend an estimated average of 13% of their after-tax incomes on energy, and that of the 489,000 Alabama families with annual incomes of $10,000 to $30,000, one quarter of the state's population, spend an estimated average of 25% of their after-tax family budgets on energy. In light of these facts, can you assure me that the President's Climate Action Plan will not increase energy costs for low- and fixed income families in my state? Can you assure any other Senators that the Plan will NOT increase energy costs for low- and fixed-income families in their states?

The President's Climate Action Plan involves multiple agencies and strategies including plans to produce cleaner energy with existing technologies, deploy new clean energy technologies, and improve energy efficiency. It is important to recognize that a substantial portion of the plan focuses on reducing energy bills for families through efficiency improvement programs directed by other agencies. For example, the recently proposed Clean Power Plan promotes investment in energy efficiency and provides States with flexibility to design their own plans to reduce carbon pollution, reducing emissions while protecting electricity consumers. Any small change in electricity prices would be within normal, historical fluctuations and any short-term increase in what we pay every month on our electric bill will still keep our bills lower than they were in 2010. In fact, if states choose to take advantage of available opportunities to increase efficiency, we expect average electricity bills will be cut by 8 percent. That means that by 2030, the average American family will save almost $9 on its electric bill every month.

4. Can you assure me that the President's Climate Action Plan will NOT increase energy costs for Alabama manufacturers?

The President's Climate Action Plan involves multiple agencies and strategies including plans to produce cleaner energy with existing technologies, deploy new clean energy technologies, and improve energy efficiency. Because these strategies are at various stages of development and implementation, generally, it is premature to speculate on the potential changes in energy costs, particularly at the state level. One action under the Climate Action plan is the proposed Clean Power Plan. This proposal specifically provides flexibility to states to meet their emission rate-based goal (in pounds of CO2 per MWh of electricity generated) in the way that works best for that state. It can rely more or less heavily on specific measures such as efficiency or renewable energy, or even pursue others such as increases in transmission efficiency or new gas generation. The state can also choose the policy or portfolio of policies that works best to achieve the goal. EPA's assessment of energy costs under the proposal shows the opportunity for state actions taken to meet Clean Power Plan goals to lower costs. For example, our assessment shows that when the plan is fully implemented in 2030, residential electricity bills would be expected to be 8% lower than without the Clean Power Plan—saving Americans almost $9 on an average monthly electric bill.

5. Even the mere threat of expensive new regulations can hinder job creation and economic growth. President Obama conceded this fact when, in 2011, he directed EPA to not move forward with reconsideration of the ozone standard "particularly as our economy continues to recover" (Pres. Obama, 9/2/2011). At the time, EPA's reconsideration of the ozone standard was considered to be one of the most expensive rules ever proposed by EPA, and it threatened thousands of jobs. It is also true that the ozone reconsideration imposed a tremendous burden on state and local governments, and cost taxpayers millions of dollars. On December 17*", I wrote you a letter, joined by all Republicans on this Committee, outlining these concerns and renewing a longstanding, unanswered request for an accounting by EPA of the costs it incurred as part of the ozone reconsideration process. EPA has had more than 2 years to answer our request, and during your confirmation process, you committed that you would answer. One day before our hearing, on January 15, 2014, EPA responded with a brief letter to my attention, declining to provide the requested information. Troublingly, EPA conceded that "...it is difficult for us to estimate, with any meaningful precision, the expenses and full-time equivalent employees used for the reconsideration of the 2008 standard specifically." This sounds like an admission by EPA that it can't provide Congress with an explanation about how much taxpayer funds were used in the ozone reconsideration process. Why can't an agency with thousands of employees produce a simple accounting of dollars and time spent on a major rulemaking effort? Would EPA be able to provide an accounting of all taxpayer

The health effects associated with ozone exposure include respiratory health problems ranging from decreased lung function and aggravated respiratory symptoms to increased emergency department visits, hospital admissions and premature death. To protect against these effects, the Clean Air Act requires EPA to review the NAAQS and their scientific basis at least every five years to determine whether revisions are appropriate.

EPA received input from a variety of stakeholders, both encouraging and discouraging us from reconsidering the standards. Then-EPA Administrator Lisa Jackson chose to reconsider the 2008 standards to ensure the nation's air quality standards were clearly grounded in science, protected public health with an adequate margin of safety, and were sufficient to protect the environment.

The EPA staff members who worked on the reconsideration of the 2008 standards are dedicated to understanding the science of public health problems from air pollution and advising the Administrator on how to set the standards. At any given time, the EPA staff may be working on some aspect of one or more of the NAAQS standards. The staff continually review health and environmental impacts of the pollutants identified in the Clean Air Act as NAAQS pollutants. During reconsideration of the 2008 standards, the EPA also held public hearings with a wide variety of stakeholders.

The EPA is always learning more about the implications of current emissions patterns for the distributions of population exposures and health risks. The Agency continues to apply some of the work from the reconsideration of the 2008 standards, in conjunction with the more recent review of the current scientific evidence, to the analysis that informs NAAQS decisions. For these reasons, it is difficult to estimate the expenses and full-time equivalent employees exclusively attributable to the reconsideration of the 2008 standards.

6. We have received official satellite temperature data for 2013, and those measurements show that global temperatures did not increase last year—continuing a trend going back to 1998. Do you dispute this fact—that global atmospheric temperatures, as measured in the lower troposphere, have not increased in over 15 years?

Recent years have been very warm compared to the historical record, whether examining tropospheric temperatures or surface temperatures. Even for the tropospheric record, which is particularly sensitive to year-to-year fluctuations from the El Niño Southern Oscillation, 2013 was the sixth warmest year on record globally, and the average of the past five years is warmer than any other five year period in the record (based on the same UAH (University of Alabama-Huntsville) dataset we believe you are referring to). For global surface temperatures, 2010 was the warmest year on record, and 2013 the 4th warmest.

Climate trends are best examined over long time periods (typically 30 years or more), and by examining multiple indicators of change. The U.S. National Academies, together with the Royal Society, recently released an overview of "Climate Change Evidence and Causes." This document discusses how, due to variability in ocean heat uptake, solar output, and other factors, decadal rates of change can be smaller or larger than long-term rates of change. The report finds that "a longer-term warming trend is still evident" when accounting for all data to the present day, and that "continued effects of a warming climate can also be seen in indicators such as increasing trends in ocean heat content and sea level rise, as well as in continued melting of Arctic sea ice, glaciers, and the Greenland ice sheet".

7. Your testimony seems to acknowledge that U.S. actions, alone, will not result in meaningful changes in global temperatures. Your written testimony provides: "The President's Plan recognizes that the United States must couple action at home with leadership abroad." Is it correct that, even if the President's entire climate agenda is implemented and his emissions reductions goals are achieved in full, there would be no significant difference in global temperatures 20, 50, or even 100 years from now (relative to current projections), unless China, India, and other large nations take similar steps to reduce their emissions by comparable amounts? While U.S. and European CO2 emissions have declined or remained fairly stable since 2000, CO2 emissions from China have increased by almost 170% since 2000. India is also increasing emissions dramatically. What firm commitments has the Administration obtained from China or India to reduce CO2 emissions?

Climate change is a global problem that will require a global solution. All nations that are significant emitters of greenhouse gases will need to take the steps necessary to reduce their emissions in the near and long term. The United States must show leadership by taking steps necessary to reduce our emissions while at the same time encouraging and facilitating the reduction of emissions from other countries.

This is why one of the three pillars of the Climate Action Plan is to lead international efforts to combat global climate change and prepare for its impacts. As stated in the Climate Action Plan, "America must help forge a truly global solution to this global challenge by galvanizing international action to significantly reduce emissions (particularly among the major emitting countries), prepare for climate impacts, and drive progress through the international negotiations."

8. According to the IEA, there are over 2,300 coal-fired power plants worldwide. In its proposed CO2 standard for new power plants, EPA proposed that U.S. coal-fired power plants be required to install carbon capture and storage (CCS) systems. Of the 2,300 coal-fired power plants in the world today, how many full scale CCS projects are operating presently?

The EPA has proposed to determine that CCS is technically feasible for new coal-fired power plants, because all of the major components of CCS – the capture, the transport, and the injection and storage – have been demonstrated and are currently in use at commercial scale. For example there are several industrial projects in the U.S. that are currently capturing the CO2 for use in

enhanced oil recovery (EOR) or other applications. There have been numerous smaller-scale projects that have demonstrated the technology, and there are several full-scale projects – both in the U.S. and internationally – that are under construction today. Thus, the EPA has proposed to determine that partial CCS is the Best System of Emission Reduction (BSER) for new coal-fired power plants.

9. In a letter to me dated December 24, 2013, the State Department acknowledged a "recent slowdown in atmospheric warming," but the President seems to deny that there is a slowdown in warming. Do you agree that we have currently experienced a period of at least 15 years without significant increases in global temperatures as measured in the lower troposphere? Have you discussed these facts concerning global temperatures with the President? Will you do so in the future to ensure his comments on the status of climate, as the nation's Chief Executive, are accurate?

As noted above, a number of indicators show continued warming in the climate system, including temperatures in the lower troposphere.

Senator Mike Crapo

1. In your testimony, you mentioned "the President asked the EPA to work with states, utilities and other key stakeholders to develop plans to reduce carbon pollution from future and existing power plants." Additionally, you mentioned the eleven public listening sessions your agency held around the country as proposed regulations were developed. However, these listening session avoided many of the areas where the President's Climate Action plan will likely have the most severe negative economic consequences.
    a. Does the EPA not view our country's top coal producing and utilizing states as "key stakeholders" in this policy debate?

Before issuing the Clean Power Plan , the EPA heard from more than 300 stakeholder groups from around the country, to learn more about what programs are already working to reduce carbon pollution, and what states think will or will not work for them. In addition, after the proposed rule was signed, during the week of July 29, the EPA conducted eight full days of public hearings in four cities. Over 1,300 people shared their thoughts and ideas about the proposal and over 1,400 additional people attended those hearings. The EPA is continuing to engage with a broad variety of stakeholders to help inform the final rule – including holding Q&A sessions and participating in dozens of individual meetings. These hearings and these meetings, with states, utilities, labor unions, nongovernmental organizations, consumer groups, industry, and others, reaffirmed that states are leading the way. The Clean Air Act provides the tools to build on these state actions in ways that will achieve meaningful reductions and recognizes that the way we generate power in this country is diverse and interconnected. The public comment period remains open and all comments submitted, regardless of method of submittal, will receive the same consideration.

2. You mentioned a threat to national security as a potential consequence of not vigorously implementing policies to combat climate change. A greater concern to me in the arena of national security, which history has shown, is the reliance on foreign energy resources from volatile regions of the world.

    a. With the abundant energy resources in the U.S., including natural gas, coal and petroleum, and the subsequent threat posed by the President's Climate Action Plan in utilizing these resources, how do you propose to promote our national security while undermining our energy security?

The President's plan will spark innovation across a wide variety of energy technologies, resulting in cleaner forms of American-made energy and cutting our dependence on foreign oil. Combined with the President's other actions to increase the efficiency of our cars and household appliances, the President's plan will help American families cut energy waste, lowering their gas and utility bills.

3. Dr. Judith Curry, PhD, Professor and Chair, School of Earth and Atmospheric Sciences, Georgia Institute of Technology, mentioned in her testimony that reducing carbon emissions is not simply a "control knob" in reducing the threat of global climate change, as evidenced by the inconsistency between emissions and temperature forecasts over the past approximately fifteen years. Reducing carbon emissions is a central pillar of the President's Climate Action Plan.

   a. If fully implemented, what would you anticipate the measurable gain, if any, the Administration's proposal would be on the issue of climate change?

   The administration is already hard at work implementing The President's Climate Action Plan. However, several of the actions will require U.S. government agencies to develop recommendations, propose new rules, augment existing activities, and undertake processes that entail significant stakeholder outreach and public comment before final rules and programs are in place. Although the purpose of each action is clear, the exact form of each will be developed over time. Until recommendations, rulemakings, and other administrative activities for these specific actions are complete, it will not be possible to estimate the exact scale of emission reductions that will be achieved by each specific action.

Senator Deb Fischer

1. Administrator McCarthy, last September, seventeen state attorneys general and one state environmental commissioner wrote to you to express their concerns regarding what they called "a serious, ongoing problem in environmental regulation: the tendency of EPA to seek to expand the scope of its jurisdiction at the cost of relegating the role of the States to merely implementing whatever Washington prescribes, regardless of its wisdom, cost, or efficiency in light of local circumstances." Specifically the states highlight the limits of EPA's authority under the Clean Air Act for regulating existing sources.

   a. Do you agree with these state officials that under the law, EPA's authority is limited to establishing a procedure by which the states submit plans for regulating existing sources?

   b. Do you agree that while EPA is authorized to require states to submit plans containing performance standards, EPA may not dictate what those performance standards shall be, nor may EPA require states to adopt greenhouse gas performance standards that are not based on adequately demonstrated technology?

Under EPA's long-standing regulations implementing Section 111(d) of the Clean Air Act, it is the responsibility of the Administrator to determine the Best System of Emissions Reduction that has been adequately demonstrated.

2. Charles McConnell, former Assistant Secretary for Fossil Energy at the Department of Energy, recently stated before Congress and to the press that carbon capture and storage technologies are not

adequately demonstrated and commercially available and viable. His message is clear, that that carbon capture is not ready for a mandate, as has been done in EPA's NSPS proposal. Multiple Administration officials have refused to address Mr. McConnell's comments. What is your response to his claims? Is he right or wrong?

The EPA has proposed to determine that CCS is technically feasible for new coal-fired power plants, because all of the major components of CCS – the capture, the transport, and the injection and storage – have been demonstrated and are currently in use at commercial scale. For example there are several industrial projects in the U.S. that are currently capturing the CO_2 for use in enhanced oil recovery (EOR) or other applications. There have been numerous smaller-scale projects that have demonstrated the technology, and there are several full-scale projects – both in the U.S. and internationally – that are under construction today. Thus, the EPA has proposed to determine that partial CCS is the Best System of Emission Reduction (BSER) for new coal-fired power plants.

3. Media reports recently revealed that EPA's Science Advisory Board (SAB) raised multiple concerns with EPA about how it went about formulating its New Source Performance Standards. The reports say that the SAB wanted to undertake a formal review of how EPA went about the process, but EPA staff pressured the SAB not to do so. What is the purpose of having an SAB if EPA does not want it to do its job?

When the Science Advisory Board (SAB) and its workgroups raise questions, the EPA takes them seriously. We use the SAB's routine, transparent, and well-established processes to better understand the nature of the questions and how we can address them. An SAB workgroup asked for information on the potential adverse impacts of carbon capture and sequestration (CCS) in November 2013 and how that issue is addressed in the proposed Carbon Pollution Standards. The SAB's transparent, deliberative process provided an opportunity for us to engage in a dialogue to better understand the workgroup's concerns and to provide a clearer explanation of the scope of the proposed rule.

After consideration of the clarifying information and thorough discussion about the issues during several meetings of the SAB that were open to the public, the workgroup recommended to the full SAB that additional review of the science of sequestration was not necessary in the proposed Carbon Pollution Standards. The full SAB agreed with the workgroup's assessment that the EPA did not propose to set any new requirements for sequestration in the Carbon Pollution Standards and that peer review of the DOE cost studies was sufficient. In a memo dated January 29, 2014, the SAB informed the EPA that it will not undertake further review of the science supporting this action.

4. A new study by Life Cycle Associates (a firm that has done work under contract for EPA) found that average corn ethanol was reducing GHG emissions by 21% in 2005; yet, EPA's analysis suggests this level won't be achieved until 2022. The final rule for the RFS2 clearly indicated that EPA would update its GHG analysis as new information became available. A number of recent papers by academia, government, and industry show that corn ethanol's GHG performance is significantly better than assumed by EPA. But the Agency has not made a single change to its original GHG analysis to reflect advanced in the science. Why?

EPA has considered more recent data on the efficiency of dry mill corn ethanol plants as part of our petition process. EPA's more recent assessments of corn ethanol plants indicates that there are a number of facilities that meet the 20 percent greenhouse gas emission reduction threshold needed to qualify as renewable fuel. These initial approvals were based on adjustments to our March 2010

lifecycle greenhouse gas analysis to account for the new data provided by these plants. We will continue to adjust our analyses as such new data are provided and as we evaluate facilities in the future.

Senator BOXER. Thank you so much, Administrator McCarthy. And we turn to Hon. Daniel Ashe.

STATEMENT OF HON. DANIEL M. ASHE, DIRECTOR, U.S. FISH AND WILDLIFE SERVICE

Mr. ASHE. Thank you, Chairman Boxer, Ranking Member Vitter and members of the committee. I want to also thank you for the chance to testify on behalf of the President's climate action plan and the U.S. Fish and Wildlife Service's role under that plan.

The best science available to us today supports the conclusion that earth's climate system is undergoing rapid and significant change, and I believe this is the greatest challenge to current and future management of our wildlife resources. I was trained as a scientist, and I lead a science driven organization. We always begin with what we know through observation.

The earth's climate is changing. It is changing at an accelerating rate. Average surface temperatures are increasing. Ocean temperatures are rising. Sea ice and glaciers are melting. Sea levels are rising. Oceans are acidifying. Plants are flowering earlier. Birds are migrating sooner. In general, wildlife species distributions are shifting northward and higher in elevation. All of these observed changes are consistent with observations in the rise of greenhouse gas emissions and with the conclusion that human emissions of those gases are driving change in the earth's climate system.

And it leads to the conclusion that we as responsible wildlife managers must anticipate that large scale ecological disruption will be an increasing aspect of the daily challenges that we face in doing our jobs. We must prepare or be unprepared to deal with the consequences.

The President's climate action plan is compelling in helping us to prepare. It asks us to reduce carbon pollution, prepare our Nation for the impacts of changing climate and help the world understand and respond to the challenge as well. It is really asking us to be the leaders that we are supposed to be.

In decades past, the U.S. Fish and Wildlife Service has been a leader in recognizing and helping prepare the Nation to deal with great environmental challenges. Market shooting and devastation of migratory birds, indiscriminate use of industrial pesticides like DDT, large scale destruction of wetlands and species extinction, great leaders prepared the organization and its employees to deal with those challenges. Today we see the emergence of a new and likely much greater challenge, climate change. It is our obligation to prepare our great institutions, like the U.S. Fish and Wildlife Service, to meet this challenge. We cannot do this alone, and the action plan compels us to work with other Federal agencies, States, tribes, local communities and the private sector and private citizens.

In March 2013, the Service worked with Federal and State agency partners to release the National Fish, Wildlife and Plants Climate Adaptation Strategy. This strategy identifies key vulnerabilities to fish, wildlife and plants and presents a unified approach to reduce the negative effects of climate change on our wildlife heritage and on the communities and economies that depend on those resources.

Since it was released, the strategy has been incorporated into guidance to all Federal agencies for their climate change adaptation planning efforts. And it is the focus of legislation introduced by Senator Whitehouse on climate change adaption for natural resources. The Service is embracing the challenge presented by climate change to the Nation's fish and wildlife resources. We realize that addressing this challenge was a good measure of success and in the long term will require our commitment, resolve, passion and creativity. We look forward to working with this committee and the Congress to enhance this most important work, work that will pass on our wildlife resource heritage to future generations of Americans.

Madam Chairman, thank you for the opportunity to testify, and especially for your leadership on this issue. During the members' presentations today, I heard many things of interest, and I heard Senator Whitehouse say do your duty. I heard Senator Sessions say, there is common ground. I think those are both words to live by, and things we can bear in mind as we go forward.

[The prepared statement of Mr. Ashe follows:]

TESTIMONY OF DAN ASHE, DIRECTOR, U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR BEFORE THE SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS REGARDING THE PRESIDENT'S CLIMATE ACTION PLAN

January 16, 2014

Introduction

Chairman Boxer, Ranking Member Vitter, and Members of the Committee, I am Dan Ashe, Director of the U.S. Fish and Wildlife Service (Service), within the Department of the Interior (Department). Thank you for the opportunity to testify on the President's Climate Action Plan.

Over the past 50 years, the phenomenon of climate change has been a significant driver for changes across our landscapes and ecosystems, which have impacted our nation's living resources – our fish, wildlife, and plants. Examples include shifts in precipitation, with more frequent and severe storms, flooding, droughts, and wildfires. Average temperatures of coastal and fresh waters are rising, and we are also experiencing rising sea levels, loss of sea ice, ocean acidification, and increased coastal flooding and erosion[1]. From the Arctic to the Everglades, these impacts are affecting wildlife species and habitat critical to the American people. As the climate continues to change over the next century, so too will the impact on species and the ecosystems they rely on. And while my testimony focuses on the impacts the Fish and Wildlife Service is seeing, it is important to note that we are seeing these dynamics play out on other federal lands and private lands alike. The federal government has an important role to play in natural resource climate preparedness and the President's Climate Action Plan recognizes this.

For example, the Department manages 35,000 miles of coastline, including 180 marine and coastal National Wildlife Refuges, making sea level rise a critical concern. National Wildlife Refuges along our nation's coasts are experiencing a rise in sea level that is destroying coastal habitats used by migrating and wintering waterfowl. Rare species that depend on these areas year-round are losing their habitat, too, as are Federally protected marine species, like polar bears and walrus. The dramatic loss of sea ice in northern latitudes – where the impacts of climate change are most profound – has reduced important feeding habitat for these species. Other refuges throughout the country are experiencing extreme drought, which, while not entirely due to climate change, starkly illustrates the impacts of climate change-driven losses of available water to fish and wildlife. Conflicts over water-needs continue to emerge, particularly as the south-central states and Pacific southwest struggle with drought-limited water sources.

The President's Climate Action Plan (Plan) released in June 2013 serves as a blueprint for responsible national and international action to slow the effects of climate change using existing authorities. Building on efforts underway in the states and local communities across the country, the Plan cuts carbon pollution while helping the nation prepare for, and ameliorate, future impacts. This is a critical and ambitious effort to address one of the major challenges of the 21st century. The Plan's recognition of the importance of protecting natural resources and promoting resilience in fish and wildlife and their habitats is an integral part of our nation's comprehensive response to climate change.

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[1] U.S. Global Change Research Program

The Plan has three key pillars:

1) Cut Carbon Pollution in the United States;
2) Prepare the United States for the Impacts of Climate Change; and
3) Lead International Efforts to Combat Global Climate Change and Prepare for its Impacts.

The Department plays a key role in the implementation of the Climate Action Plan. Under the plan, the Department has several responsibilities, including reducing methane emissions; accelerating clean energy permitting; contributing to efforts to prepare the U.S. for the effects of climate change; protecting wildlife; helping Indian tribes adapt to climate change; and developing actionable climate science.

The Service has already made significant progress toward preparing for climate change, the second key pillar of the Plan. We are actively working with states, local communities, and the private sector to meet the goals of this important action plan. Below are examples of actions the Service is undertaking that focus on our efforts to help put fish, wildlife, and plants in the best position to adapt to the effects of climate change.

Preparing the United States for the Impacts of Climate Change

The Plan calls on agencies to identify vulnerabilities of key sectors to climate change. The mission of the Service is, working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. Our focus under the Plan is the effects of climate change on fish, wildlife, and plants and how we must act to ensure that these resources are conserved for the American people over the long term. In 2010, the Service was among the first federal agencies to develop a Climate Change Strategic Plan, which referred to climate change as, "the greatest challenge to fish and wildlife conservation in the history of the Service." This Strategic Plan established a basic framework to help ensure the sustainability of fish, wildlife, plants and habitats in the face of accelerating climate change.

Climate Adaptation Strategy – Language in the Conference Report for the Fiscal Year 2010 Interior, Environment and Related Agencies Appropriations Act (House Report 111–316, pages 76–77) recognized the imperative to address the impacts of climate change on natural resources. The Conference Report urged the Council on Environmental Quality (CEQ) and the Department to ''develop a national, government-wide strategy to address climate impacts on fish, wildlife, plants, and associated ecological processes'' and ''provide that there is integration, coordination, and public accountability to ensure efficiency and avoid duplication.'' Taking this charge, the President's Interagency Climate Change Adaptation Task Force, convened by CEQ, called for the development of a climate adaptation strategy for fish, wildlife, and plants in its 2010 Progress Report to the President, as did the Service's Strategic Plan.

In response, the Service helped chair and develop the interagency National Fish, Wildlife and Plants Climate Adaptation Strategy (Strategy), released in March of 2013. This Strategy identifies key vulnerabilities and presents a unified approach – reflecting shared principles and science-based practices – to reduce the negative impacts of climate change on fish, wildlife, plants, our natural resource heritage, and the communities and economies that depend on them.

Our efforts to develop the Strategy were co-led by the National Oceanic and Atmospheric Administration (NOAA) and the New York State Department of Environmental Conservation, representing state fish and wildlife agencies. The Strategy was developed in close coordination with other federal adaptation efforts such as the National Ocean Policy Implementation Plan and the Freshwater National Action Plan (led by the U.S. Geological Survey and the Environmental Protection Agency), and it draws from existing adaptation efforts by states, Federal agencies and others.

The Service is now co-leading (along with NOAA and the Association of Fish and Wildlife Agencies, and with support from CEQ) a Joint Implementation Working Group that is promoting implementation of the Strategy and will be responsible for reporting on Strategy implementation and future revisions. The fact that state agencies are integrating the recommendations of the Strategy into state planning is a testament to its value.

Vulnerability Assessments – The Service is actively conducting vulnerability assessments for species and habitats across the country to improve understanding of how climate change will affect our trust resources in the coming years. Climate change vulnerability assessments are used in conjunction with analyses of non-climate stressors to assess the overall vulnerability of species and habitats and plan for needed management activities.

In 2011, the agency worked with partners to develop the report "Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment." This report seeks to help resource managers understand the impacts of climate change on species and ecosystems and to support efforts to safeguard these valuable natural resources.

Safeguarding Communities and Economies – The Plan recognizes that protecting America's ecosystems is critical to safeguarding the communities and economies that depend on them, and that healthy natural resources can help reduce the impacts of climate change on people as well as nature. Every year, coastal habitats such as coral reefs, wetlands, and mangroves provide protection for people, infra-structure, and communities from storms, erosion, and flood, avoiding potentially billions of dollars of damage. Forests help provide clean drinking water for many cities and towns, while our urban forests help alleviate urban heat island effects and manage stormwater. Hunting, fishing, and other wildlife-related recreation in the United States is estimated to contribute over $140 billion to our Nation's economy annually, which is approximately one percent of the Nation's gross domestic product[2]. The Service works to protect these natural ecosystems and promote resilience in fish and wildlife populations, forests and other plant communities, and freshwater resources in part to ensure they can continue to provide these important benefits to people and communities.

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[2] USFWS 2011 National Survey of Fishing, Hunting, and Wildlife Associated Recreation

Addressing sea level rise: At Alligator River National Wildlife Refuge on the North Carolina coast the Service is working with partners to evaluate the effects of different adaptation strategies on areas impacted (or likely to be impacted) by sea level rise, to determine how to make the shoreline more resilient to rising sea levels. The strategies include constructing oyster reefs to buffer shorelines from waves and storm surges, restoring the natural hydrologic regime and associated wetland systems, and planting salt- and flood-tolerant species. The goal of this project is to facilitate a transition to salt marsh and open-water habitats that is an inevitable consequence of sea level rise in this area. The project will lead to outcomes that will inform adaptation efforts in other parts of coastal North Carolina as well as throughout the United States and around the world.

Within the boundaries of the Blackwater National Wildlife Refuge on Maryland's Eastern Shore, 5,000 acres of marsh have been lost since the late 1930s from a combination of factors including destruction by nutria, an introduced species, land subsidence, and rising sea levels. For two years, the Service has been working with Federal, state and local partners and individual experts to assess the process of sea level rise and set forth key strategies to enable these tidal marshes to persist for the benefit of people and the special birds that need this habitat for survival, as well as Chesapeake Bay fisheries that depend on these wetlands for shelter and food Steps can be taken to slow the rate of loss of these tidal marshes and improve their health, and to ensure the marsh has room to move and re-establish as the sea level rises. Techniques include adding thin sediment layers through hydraulic pumping to increase the marsh surface elevation and fill in eroded areas, etching shallow channels to connect the failing marsh areas to existing tidal creeks and lower their water levels, acquiring upland areas to allow the marsh to rise, and controlling growth of invasive plants that crowd out more desirable native grasses favored by salt marsh birds.

Restoring the Gulf: In the Gulf of Mexico, climate change, sea level rise, subsidence, habitat conversion and fragmentation, decreasing water quality and quantity, and invasive species have diminished the resilience of the ecosystem. In Louisiana, coastal wetlands in the world's third largest delta are being lost every day, taking with them nature's best storm protection and water filter as well as habitat teeming with sea life that helps support the region's critical commercial fisheries. Natural disasters like hurricanes and manmade disasters like oil spills only exacerbate these losses.

In the wake of the April 2010 Macondo 252 Deepwater Horizon oil spill, the Service is working with state, tribal and other federal partners to identify and determine the extent of injuries suffered by natural and cultural resources. Through the Natural Resource Damage Assessment process, and the Gulf Coast Ecosystem Restoration Council, the Service and these other governments and agencies will seek to recover damages from those responsible and plan and carry out natural resource restoration, which will include anticipating the effects of climate change on long-term restoration projects.

In addition, the Service is working to build resilience in the Gulf by using the National Wildlife Refuges as key ecological links in connecting existing conservation lands, larger landscapes, buffer areas and corridors in order to make the system more resilient and provide fish and wildlife species the ability to migrate and move across the landscape.

Reducing wildfire risk: The Plan directs agencies to work with tribes, states, and local governments to take steps to reduce wildfire risks, which are exacerbated by heat and drought conditions partially resulting from climate change. Because some fish and wildlife species depend on habitats that are maintained or rejuvenated by fire, the Service uses prescribed burning to stimulate a vigorous regrowth of healthy, nutritious plants that provide better food and cover for these species. More frequent, managed fires can also help reduce the fuel built up in natural communities that might otherwise be subject to large and extremely hot and destructive wildfires.

The Service's fire program is responsible for protecting more than 75 million burnable acres; many of these are small coastal and urban tracts with extensive wildland-urban interface areas along the East, West, and Gulf Coasts and in the Midwest. The Service's fire management program includes hazardous fuels reduction, wildfire management, and wildfire prevention.

And in November of last year, DOI joined six other agencies to announce the National Drought Resilience Partnership to make it easier for communities seeking help to prepare for future droughts and reduce drought impacts. This Partnership enhances the efforts of Federal agencies already working with communities, businesses, and farmers and ranchers to build resilience to drought and help prepare their communities for future drought events.

The Service is also working with states, universities and non-profit partners on America's Longleaf Restoration Initiative, working to expand the longleaf pine forest in the Southeastern United States. A prime example of the importance of large-landscape restoration, one of the goals of the initiative is to establish functional connectivity across large geographic areas to conserve large-area dependent species and resilience to known and potential environmental stresses, including hurricanes, catastrophic fire and climate change. Research conducted by the U.S. Forest Service has suggested that longleaf pine is especially adapted to climate change, in part due to its resistant to drought and high temperatures.

Recovering from Hurricane Sandy: The Plan pilots innovative strategies in the Hurricane Sandy-affected region to strengthen communities against future extreme weather and other climate impacts. Coastal wildlife refuges and marshes provide protection and buffering for inland areas from storms, such as the devastating Hurricane Sandy. In October of 2013, Secretary of the Interior Sally Jewell announced that a total of $162 million would be invested to help heal the devastation caused by Hurricane Sandy and make our coastal areas more resilient against future storms and a changing climate. Secretary Jewell stated that "our public lands and other natural areas are often the best defense against Mother Nature."

Service projects are designed to increase resilience by restoring coastal marshes, conducting beach and dune restoration, providing aquatic connectivity in streams and rivers, and by providing integrated science decisions that bring partners and science together to reduce redundancy and increase the effectiveness of conservation actions.

By restoring aquatic connectivity and preserving and rebuilding natural ecosystems, services will be provided that better protect and benefit wildlife, communities, and the economy. For example, the Service has been working to clean up trees and debris left behind by Hurricane Sandy and restore protective coastal marshes at multiple refuges including Wertheim, Target Rock and Elizabeth A. Morton National Wildlife Refuges in New York. The Service is also working to restore and enhance tidal marshes, replace invasive plants with native ones, preserve wildlife habitat and mitigate damage from future storms to coastal communities and infrastructure.

Cutting Carbon Pollution in America

The Service plays a role in helping to cut carbon pollution though improvements in infrastructure and operations, and carbon sequestration.

Infrastructure and Operations/Reducing Carbon Pollution – The Plan sets a goal for the Federal government to be a leader in clean energy and energy efficiency, as well as to increase the resilience of federal facilities and infrastructure. The Service is contributing to this goal by substantially lowering its building energy intensity (energy consumption per square foot of building space) and its potable water consumption intensity (gallons per square foot); reductions that meet or exceed the requirements of Executive Order 13514, *Federal Leadership in Environmental, Energy and Economic Performance.*

The Plan commits the federal government to building a 21st-Century transportation sector. The Service has taken considerable steps to improve the composition of our motor vehicle fleet by replacing over 10 percent of our motor vehicle fleet with more fuel efficient vehicles during FY2010. This change of fleet composition is expected to reduce petroleum fuel use by approximately 185,000 gallons of petroleum fuel per year and reduce GHG emissions by approximately 1,639 metric tons of carbon dioxide annually.

Biological Carbon Sequestration – The Plan commits to protecting our forests and critical landscapes, and to preserving the role of forests and coastal wetlands in mitigating climate change. The Service has made a considerable investment in biological carbon sequestration through our continuing efforts to restore and create fish and wildlife habitats under our statutory mandates. These efforts are important to our mission to conserve the wildlife of America and they also contribute to the reduction of greenhouse gas concentrations in the atmosphere.

We have implemented biological carbon sequestration projects across the Nation, including the reforestation of more than 80,000 acres of refuge lands in the Lower Mississippi River Valley, an important bottomland hardwood forest ecosystem in Mississippi, Louisiana, Arkansas, and Missouri, since the early 1990s. These projects are restoring valuable habitats for wildlife – including endangered species – while capturing and storing thousands of tons of carbon over their lifetimes.

Conclusion

The President's Climate Action Plan supports three common-sense and essential areas of ongoing efforts by the Service: (1) conserving the wildlife of America for the long term by leading efforts to help fish and wildlife adapt to the effects of climate change; (2) reducing GHG emissions by improving the energy efficiency of our infrastructure and vehicle fleet; and (3) removing carbon from the atmosphere through biological carbon sequestration. The Service is embracing the challenge presented by climate change to the Nation's fish and wildlife resources and we look forward to working with this Committee and the Congress to enhance this most important work.

Environment and Public Works Committee Hearing
January 16, 2014
Follow-Up Questions for Written Submission

Questions for Ashe

Questions from:

Senator Barbara Boxer

1. **Can you describe what climate change impacts the FWS is already seeing on the ground and what your scientists are telling you is expected in the coming years?**

   Response: Climate change is now among the greatest challenges facing the conservation of our native species and it is contributing to dramatic changes in the habitats they need for breeding, migrating, and wintering. In addition, climate change is impacting the dynamics of wildlife disease, which also threatens biodiversity.

   As the Earth warms, ecosystems adapted to cooler climates are altered, creating new habitat for some species and reduced habitat for others. Species distribution shifts in response to climate change can lead to a number of changes, such as the arrival of new pests, the disruption of ecological communities and interspecies relationships, and the loss of particularly valued species from some areas. Warmer temperatures cause changes to plant communities and shorten insect life cycles. This can lead to disruption in the annual appearance of these important food sources at times out of sync with bird migration and breeding cycles, further impacting ecosystems.

   Our scientists are observing a number of changes throughout the country, including: in the Arctic, record losses of sea ice over the past decade are affecting the distribution, behavior, and abundance of polar bears, animals that are almost completely dependent upon sea ice for survival. In the Southeast, rising sea levels are expected to flood as much as 30 percent of the habitat on the Service's coastal national wildlife refuges. In the Southwest, climate change is already exacerbating deep droughts, increasing pressure on water uses at national fish hatcheries and national wildlife refuges. In the Northwest, climate change is warming the landscape and enabling insect pests to expand their ranges and destroy ecologically and commercially valuable forests. Throughout the West, there is also clear evidence that wildfires have been larger and more severe since the mid-1980s.[1]

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[1] Westerling et al. (2006) compiled a comprehensive database of large wildfires in western United States forests since 1970 and compared it with hydroclimatic and land-surface data. They demonstrated that large wildfire activity increased suddenly and markedly in the mid-1980s, with higher large-wildfire frequency, longer wildfire durations, and longer wildfire seasons.

Dennison et al. (2014) used a database capturing large wildfires (> 405 ha) in the western US to document regional trends in fire occurrence, total fire area, fire size, and day of year of ignition (DOY) for 1984-2011. Over the western US and in a majority of ecoregions, they found significant, increasing trends in the number of large fires

2. **What are the consequences of not starting now to prepare our refuges and other conservation lands for the impacts of climate change?**

   Response: Climate change is already beginning to impact national wildlife refuges and other important public lands. For example, observed sea level rise has already impacted coastal habitat used by shorebirds and sea turtles that nest on coastal national wildlife refuges. Dramatic and measurable loss of sea ice is impacting wildlife in the northern latitudes, where the impacts of climate change are most profound. The Service is already working with other entities to address these changes over the long-term and build resiliency; but, the longer these climate changes remain unaddressed, the more difficult and expensive they will be to deal with in the future as more lands are impacted.

3. **Hunting, fishing and other wildlife-recreation activities contribute billions of dollars to the U.S. economy every year. What impacts will climate change have on these activities?**

   Response: According to the latest National Survey of Hunting, Fishing and Wildlife-associated Recreation, more than 90 million Americans participated in some form of wildlife-related recreation in 2011. These wildlife recreationists spent $144.7 *billion* on their activities. Because climate change is known to affect the distribution and abundance of species, the availability of culturally, commercially, and recreationally important species for human uses (e.g., fishing, hunting, watching) will change as species distributions respond to a changing climate and human population pressures. Availability of those species will ultimately affect subsistence and commercial use, recreation, tourism, and the economy.

   Although we have not seen a comprehensive study of the economic impacts of such future changes across all components of the wildlife recreation sector, at least one recent effort was made to estimate such changes on freshwater recreational fishing component (Jones et al. 2013. Climate change impacts on freshwater recreational fishing in the United States *Mitig Adpat Strateg Glob Change* 18:731-758). The study found that coldwater fisheries are expected to decline in distribution and be replaced by an expansion of warm water fisheries. Because cold water fisheries are more economically valuable, the resulting losses from such shifts in the relative availability of the two fisheries between 2009 and 2100 were projected to be $81 million to $6.4 billion depending on the global emission scenario evaluated and the discount rate applied - this for just one component of the overall wildlife recreation sector.

   In addition, hunting and fishing success, and the quality of experience, is highly dependent on environmental conditions, including temperature, precipitation, wind, water

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and/or total large fire area per year. Trends were most significant for southern and mountain ecoregions, coinciding with trends towards increased drought severity.

stages, tides, timing of insect hatches, etc. The greater uncertainties associated with climate change could cause subtle but important shifts in how people make decisions about participation.

4. **Do your partners in the hunting and angling communities believe that climate change is a serious issue that must be addressed?**

   Response: Yes. Hunters and anglers are often among the first to see impacts of climate change on species since they often directly observe when species shift their geographic ranges and are no longer common in traditional areas. For instance, geese that formerly wintered along the Missouri River in Nebraska and South Dakota now seem to migrate only as far south as North Dakota, to the dismay of waterfowl hunters. In the Arctic, changing ice conditions are threatening lifestyles and subsistence economics of indigenous peoples as well (e.g., making trips to hunting grounds longer and more hazardous).

   A broad-based coalition of hunting and fishing organizations published reports in 2008 and 2009 on the current and future impacts of climate change on fish and wildlife and called for increased action to help sustain these resources in a changing climate (Wildlife Management Institute 2008, 2009). This coalition included such major hunting and fishing associations and/or groups as: Ducks Unlimited, Trout Unlimited, BASS/ESPN Outdoors, Izaak Walton League of America, the Association of Fish and wildlife Agencies, the Coastal Conservation Association, the American Sportfishing Association, Pheasants Forever, and the Boone and Crockett Club.

Senator David Vitter

1. **I understand the Fish and Wildlife Service has gotten involved in an EPA rule being proposed to regulate waters that are used to cool power plants and other facilities. This 316(b) rule was supposed to be finalized last year, but has gone through a series of delays, and I'm concerned that your agency's involvement has caused further confusion as it relates to the Endangered Species Act.**

   a. **Can you tell me why your agency continues, after months, to review this EPA rule, because I'm concerned that if new layers of ESA requirements are layered on a national rule like this, it's going to set a dangerous precedent? As you know, this Committee has focused extensively on the "sue and settle" practice, and this seems to be yet another example of overreach where a new path to even more litigation will be created.**

   b. **Our local permit writers in our states won't have the flexibility they need to make decisions on a project-by-project basis. Mr. Ashe, do you support the EPA's clear finding in their Biological Opinion that this 316(b) once-through cooling rule clearly provides benefit to species in the way it's drafted?**

Response: The Endangered Species Act and its implementing regulations require Federal agencies to consult with the Fish and Wildlife Service (and the National Marine Fisheries Services, together as the Services) if the agency determines that their action "may affect" listed species or designated critical habitat.

As described in the letter dated June 18, 2013, EPA submitted a biological assessment that determined that the issuance and implementation of the proposed regulations may affect 215 threatened and endangered species and the designated critical habitat of 30 species. The biological assessment described the likely impingement or entrainment of endangered or threatened species and it is those effects that form the basis for the ongoing ESA section 7 consultation.

2. **As FWS coordinates Federal environmental efforts and works closely with agencies and White House offices in the development of environmental policies and initiatives, FWS plays a role in, utilizes, and is impacted by the SCC estimates.**

   a. **Did you participate in the development of these estimates in any way?**

   b. **Did you or any of your direct reports participate, provide assistance, technical analysis, or input of any kind during the development of and revisions to the SCC estimates in any manner?**

   c. **Please provide for the record which of your Agency's offices participated in the development of the SCC estimates, including the number of staff, hours, and other resources dedicated to such work, as well as any outside experts, entities or consultants who provided input, technical assistance or comments.**

Response: The Service was not involved in the effort to develop a Social Cost of Carbon.

3. **Any ESA monitoring and study requirements must be focused on T&E species directly affected by the intake through entrainment or impingement. We understand that the proposed ESA provisions in 316(b) will require permittees to identify listed species that *may* be in the water bodies from which a facility draws water and *might be* indirectly affected by intake structures. How does such an approach comport with the Endangered Species Act or the Clean Water or 40 years of precedent?**

Response: In a letter dated June 18, 2013, EPA requested ESA Section 7(a)(2) consultation with the National Marine Fisheries Service (NMFS) and the Fish and Wildlife Service (together, the Services). The Services are now in consultation with EPA on the 316(b) proposal. When the Service issues its biological opinion and the EPA determines how to proceed with their final rule, we would be happy to discuss details of any provisions related to conservation of threatened or endangered species.

4. **The approach proposed to be used to incorporate proposed ESA provisions into the state 316(b) permitting process represents a dramatic departure from the current**

NRC-initiated Section 7 consultations procedure used for nuclear facilities that involves multiple federal agencies. Having the ESA consultation take place prior to submittal of a state permit application would shift the decision-making to a single federal agency. Rather, any ESA study or consultation should occur as an integral part of the current permitting process and not separately. What are your thoughts on this?

Response: As stated in the response to Q3, in a letter dated June 18, 2013, EPA requested ESA Section 7(a)(2) consultation with the National Marine Fisheries Service (NMFS) and the Fish and Wildlife Service (together, the Services). The Endangered Species Act and its implementing regulations require Federal agencies to consult with the Services if the agency determines that their action "may affect" listed species or designated critical habitat. The Services are now in consultation with EPA on their 316(b) rulemaking. When the Service issues its biological opinion and the EPA determines how to proceed with their final rule, we would be happy to discuss details of any provisions relating to conservation of threatened or endangered species.

5. **How much has the FWS spent on climate change-related activities, including those in furtherance of the Climate Action Plan, since 2008?**

   Response: The Service does not track all of the funding it may be using to address climate change issues. Climate change is one factor that should be considered in most planning documents, such as recovery plans and refuge CCPs, yet the Service does not attempt to determine how much planning funding is spent on those considerations.

   The Service does identify specific activities that contribute to climate change in a landscape conservation cross-cut, which is attached below (in thousands of dollars).

Climate/Landscape Conservation	**2010 Enacted**	**2011 Operating Plan**	**2012 Enacted**	**2013 Enacted**	**2014 Enacted**	**2015 President's Budget**
Fish and Wildlife Service						
Cooperative Landscape Conservation	10,000	14,727	15,475	15,416	14,416	17,706
Adaptation Strategies	10,000	16,243	16,723	20,235	10,767	15,149
Partners - Private Lands	6,000	6,000	5,990	5,589	5,589	5,589
National Wildlife Refuge System	12,000	20,000	19,968	20,433	22,968	22,968
National Fish Habitat Action Plan	2,000	2,000	1,997	1,863	1,863	1,863
Science Support	0	0	0	0	2,500	2,500
Subtotal, Fish and Wildlife Service	**40,000**	**58,970**	**60,153**	**63,536**	**58,103**	**65,775**

6. **The purpose of the Endangered Species Act is to protect and conserve endangered and threatened species. Certain environmental groups believe the FWS should use the ESA to require the reduction of greenhouse gas emissions for activities that occur outside the range of species that are listed as threatened or endangered. How**

will you ensure that the Fish and Wildlife Service does not allow use of the ESA as a back-door mechanism to regulate greenhouse gas emissions?

Response: The Service is committed to ensuring that the ESA is implemented in a manner that is consistent with the Act's provisions and associated regulations. The Service continues to take the position that there is no basis for regulating greenhouse gas emissions under the ESA, and does not use any aspect of the Act for such a purpose.

7. **Please provide me with a list of species the Fish and Wildlife Service has listed as endangered using global climate change as the primary reason for listing the species.**

   Response: The Service has not yet listed any species as an endangered species based on the effects of climate change being the primary threat.

8. **Please provide me with a list of species that the Fish and Wildlife Service has listed as threatened using global climate change as the primary reason for listing the species.**

   Response: The Service has listed the polar bear as a threatened species based on the effects of climate change being the primary threat.

9. **Among the remaining species on the listing workplan that was developed after the 2011 closed door settlement agreements, please provide me with a list of species where climate change is expected to be cited as the primary threat to species recovery as you determine whether to list the species as threatened or endangered.**

   Response: We have proposed to list the wolverine and the red knot as threatened species due to the effects of climate change being the primary threats. Additionally, the Pacific walrus has been identified as a candidate species due in part to climate change.

10. **Please describe how the FWS determines whether climate change poses a threat to a species.**

    a. **How does the agency make use of climate models?**

    b. **How does the agency determine whether climate change models – or any other model relied upon to support an ESA determination – is verifiable and accurate?**

    c. **In any instances, have climate models used by the FWS to make a listing determination been inaccurate?**

    Response: (a) The Service considers information from science-based climate models regarding ongoing and projected changes in climate; these are most commonly expressed in terms of changes in average surface air temperature over time. Climate projections at a global scale are informative and in some cases are the only or the best scientific information available. However, projected changes in climate can vary substantially across and within different regions of the world and therefore the FWS uses "downscaled" projections when they are available and have been developed through appropriate scientific procedures. Such projections provide higher resolution information that is more relevant to spatial scales used for analyses of a given species and its habitat. The Service considers the uncertainty associated with the model projections as well as uncertainty about the effects on a species and its habitat; this information is included as part of the determinations.

(b) The agency uses information from models that have undergone scientific peer review. The administrative record for listing determinations always includes references for sources of information.

(c) Various climate models are routinely updated by scientists to improve and refine them. This often is reflected by the models being better able to characterize conditions and trends that already have been observed, which results in increased confidence in revised projections of future conditions. We are not aware of any instances in which the climate models used by the FWS to make a listing determination have been "inaccurate", although in some cases updated models are yielding projections that refine the magnitude and timing of likely changes.

Senator James Inhofe

1. **Mr. Ashe, on December 30, 2013, Richard Hatcher, Director of the Oklahoma Department of Wildlife Conservation, wrote to you about the American Burying Beetle (ABB). For years, entities operating within the range of the ABB were permitted to use the Baiting Away and Trapping and Relocation conservation measures to avoid taking the ABB. In April 2012, the Fish and Wildlife Service (Service) abruptly disallowed this practice; since then, the Service has not provided a new General Conservation Plan (GCP) with acceptable conservation practices. As a result, the only way to avoid a take of the ABB is to completely avoid its habitat. This has disrupted hundreds of millions of dollars in economic activity, and one company has even sustained losses of $12 million because the Service has failed to provide alternative conservation practices. In the letter, Director Hatcher outlines a series of steps that can address concerns that have been raised by critics of the two legacy conservation methods; he requests that these adapted methods be allowed while the Service continues work on the new GCP, which is not expected to be completed until December 2014.**

    a. **Will you approve Director Hatcher's request that the modified conservation practices be allowed during the interim time period?**

Response: On January 21, 2014, the Service provided a response to Mr. Hatcher's letter regarding the American Burying Beetle (ABB) and explained that while the Service appreciates his suggested modifications of the bait away and trap-and-relocate methods, the modifications to reduce or minimize potential take of ABBs do not result in complete avoidance of take.

The Service decision to discontinue the use of the two methods, bait away and trap-and-relocate, was based on our ongoing review of scientific information related to conservation of ABB. A determination was made that neither method resulted in complete avoidance of impacts to ABBs. The best available information indicates that implementation of bait away and trap-and-relocate measures could minimize, but not avoid, take. Lacking adequate means of avoiding take, projects cannot proceed and remain in compliance with the Endangered Species Act (ESA). Consequently, in the absence of ESA permits for incidental take of the species, companies or individuals using these methods could risk violation of the ESA. We continue to work on the development and approval of the GCP, so that we will provide industry and private land-owners incidental take coverage and a more certain compliance vehicle for the ABB.

We anticipate making available an 18-month Industry Conservation Plan (ICP) for oil and gas and draft environmental assessment for the ABB in the coming weeks. The draft ICP will provide industry with a mechanism for incidental take authorization associated with construction, operation, maintenance, repair and decommissioning of oil and gas projects within a 45-county planning area in Oklahoma. The draft ICP also describes measures to minimize and mitigate impacts to the ABB and its habitat. There will be a 14-day comment period for the ICP and draft environmental assessment.

Senator Jeff Sessions

1. **On November 14, 2012, President Obama stated that "the temperature around the globe is increasing faster than was predicted even 10 years ago." Again, on May 29, 2013, the President stated: "We also know that the climate is warming faster than anybody anticipated five or 10 years ago." But the actual temperature data shows that is not correct. Do you believe the President was correct when making these specific assertions?**

   Response: In matters related to climate data, the Service primarily relies upon the best available science as presented in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) and the draft 2013 National Climate Assessment (NCA) for the United States, produced under the auspices of the U.S. Global Change Research Program. According to the IPCC, "It is certain that Global Mean Surface Temperature has increased since the late 19th century. Each of the past three decades has been successively warmer at the Earth's surface than all the previous decades in the instrumental record, and the first decade of the 21st century has been the warmest." The IPCC indicates the U.S. average temperature has increased by about 1.5°F since record keeping began in 1895 with more than 80% of this increase having occurred since 1980. The most recent decade was the nation's warmest on record and U.S. temperatures are expected to continue to rise. Because human-induced warming is superimposed on a naturally varying climate, the temperature rise has not been, and will not be, smooth across the country or over time. For example, the NCA notes that observations of global mean surface air temperature show short periods with little or even no significant upward trend (for example the periods 1977-1985, 1989-1996, and 1998-2006), whereas global temperature continues to rise unabated over long-term climate timescales.

2. **In your written testimony, you cited "more frequent and severe storms, flooding, droughts, and wildfires" as observations that support the policies outlined in the President's Climate Action Plan. This is a familiar assertion, and one that our committee has examined closely. Based on the testimony offered in our committee to date, it seems clear that the frequency of extreme weather events is not, in fact, increasing on climate timescales. For instance, Dr. Roger Pielke, who is a climate-impacts expert and agrees with the view that global warming is partly caused by human emissions, testified: "It is misleading, and just plain incorrect, to claim that disasters associated with hurricanes, tornadoes, floods, or droughts have increased on climate timescales either in the United States or globally." To support his view, Dr. Pielke provided specific data points to back up his assertion. Other witnesses provided similar testimony. Please provide the data you have personally evaluated to justify your claim that we are experiencing "more frequent and severe storms, flooding, droughts, and wildfires." In addition, please provide data you have reviewed that demonstrates that implementation of the President's Climate Action Plan will result in reductions in the severity and frequency of storms, floods, droughts, and wildfires.**

   Response: This question refers to testimony provided for the January 16, 2014 hearing entitled "Review of the President's Climate Action Plan" before the Senate Committee on Environment and Public Works Committee and was asked in a letter from Senator Sessions dated January 28, 2014. Please refer to our response to that letter dated, April 7, 2014.

Senator BOXER. Thank you so much.

And we turn to Hon. Nancy Sutley, who is the Chair of the Council on Environmental Quality.

STATEMENT OF HON. NANCY H. SUTLEY, CHAIR, COUNCIL ON ENVIRONMENTAL QUALITY

Ms. SUTLEY. Thank you, Madam Chairman, Ranking Member Vitter and members of the committee. Thank you for the opportunity to discuss the President's climate action plan.

The President believes we have an obligation to our children to reduce carbon pollution, to protect our future. The climate action plan builds on steps the Administration has already taken to cut carbon pollution and to strengthen our economy by supporting domestic clean energy jobs. As you heard, the plan has three pillars: cutting carbon pollution at home, preparing the Nation for the impacts of climate change we can avoid and leading international efforts to address this global challenge.

The key part of the plan is to reduce carbon pollution in the United States. The Administration is already making significant progress. In the last 5 years, the U.S. has more that doubled renewable energy generation from wind, solar and geothermal sources. We are setting a goal to double electricity production from these sources again by 2020.

We are also focusing efforts on energy efficiency. As you have heard, we have established new fuel economy and greenhouse gas standards that will double the efficiency of our cars by the middle of the next decade and help families save money at the pump. Also established the first-ever fuel economy and greenhouse gas standards for heavy duty trucks, buses and vans, and the plan promises a second round of standards for heavy duty trucks.

The plan also sets a goal to reduce carbon pollution through energy efficiency and standards for appliances and energy efficiency efforts in Federal buildings. Since August, the Department of Energy has proposed or finalized several energy efficiency standards for appliances and other products. When combined with other energy efficiency standards issued by the Administration, they will help cut consumer electricity bills by hundreds of billions of dollars.

We are also focused on making sure that the Federal Government is leading by example. Since 2008, Federal agencies have reduced their greenhouse gas emissions by almost 15 percent. The President recently directed agencies to consume 20 percent of their electricity from renewable sources by 2020, more than double the current goal.

Even as we work to cut carbon pollution, we also need to take action to address the impacts of climate change that can't be avoided. We know as the earth continues to warm, we can expect more frequent extreme weather events, including large storms, severe droughts and heat waves. In 2012, weather and climate disasters caused over $110 billion in damage. Last summer the Administration released the Hurricane Sandy rebuilding strategy. The strategy focuses on helping the region build to be more resilient to deal with future storms. As part of these efforts, the Department of Housing and Urban Development and its partner agencies are investing in safe and more resilient infrastructure, and the Federal

Transit Administration is strengthening public transit systems affected by the storm. These efforts can serve as a model for communities across the country.

The President also signed an executive order directing agencies to help communities strengthen their resilience to extreme weather and other climate impacts. The agencies are directed to modernize their programs to better support local preparedness, to better manage our natural resources to improve resilience and to develop information and tools to help local decisionmakers. The executive order also established a task force of State, local and tribal elected leaders to advise the Administration. Their recommendations will be vital to ensure that the Federal Government responds to the needs and priorities of communities when addressing the impacts of climate change.

Finally, all agencies are now examining how a change in climate will affect their missions. Last February, Federal agencies for the first time released their climate change adaption plans, outlining strategies to reduce their vulnerability to the impacts of climate change.

As you have heard, we also understand that our response to climate change must be global and we are committed to playing a leadership role that can support a strong international response. The Administration is pursuing this through multiple channels, including the United Nations Framework Convention on Climate Change, as well as multi-lateral and bilateral initiatives focusing on tackling the key drivers of greenhouse gas emissions.

The impacts of climate change are being shouldered by communities, families and businesses across the country. For the sake of our economy and the legacy that we leave our children, it is vital to address this problem head-on. Thank you for listening, and I look forward to your questions.

[The prepared statement of Ms. Sutley follows:]

Testimony of Nancy H. Sutley
Council on Environmental Quality
Before the
Committee on Environment and Public Works
Hearing on the President's Climate Action Plan
January 16, 2014

Chairman Boxer, Ranking Member Vitter, and Members of the Committee, thank you for the opportunity to discuss the President's Climate Action Plan.

The President believes that we have a moral obligation to our children to do what we can to reduce carbon pollution for the sake of their future. That is why four years ago, he made a commitment to reduce United States greenhouse gas emissions in the range of 17 percent below 2005 levels by 2020. We are making significant progress towards meeting that goal. Our emissions of carbon pollution have fallen significantly, even as our economy has continued to grow.

The Climate Action Plan builds on the many steps that this Administration has taken to cut carbon pollution and strengthen our economy by supporting and creating domestic clean energy jobs.

The Plan has three key pillars: cutting carbon pollution at home, preparing the Nation for the impacts of climate change we can't avoid, and leading international efforts to address global climate change.

As you know, the Council on Environmental Quality's (CEQ) unique statutory mission is to play a coordinating role among Federal agencies under the National Environmental Policy Act (NEPA), as well as oversee implementation of the Administration's broader environmental policy goals. At CEQ, we have supported the Federal Agencies in developing cross-cutting initiatives that have laid the groundwork for many aspects of the Climate Action Plan. Now, we are helping to oversee the plan's implementation and ensure its success.

I know my colleagues Gina McCarthy, Dan Ashe, and Dan Tangherlini will share their respective agencies work in implementing the Plan. I will focus my testimony on our broader Administration efforts to implement the Plan.

Cutting Carbon Pollution

A key part of the Plan is to reduce carbon pollution in the U.S, and the Administration is already making significant progress in this area.

In the last five years, the United States more than doubled renewable energy generation from wind, solar and geothermal sources. In fact, renewable energy is quickly growing as a significant source of electric power generation in the Nation. In 2012, wind energy was the largest source of new capacity, with nearly 8,000 MW installed. To continue this progress, we've set a goal to double electricity production from wind, solar and geothermal sources again by 2020.

To help meet this goal, the Department of the Interior (DOI) is working to permit an additional 10 GW of renewable energy projects on public lands by 2020, enough to power 6 million homes. Since June of last year, DOI has approved enough renewable energy projects to power more than 200,000 homes. DOI has also held the first competitive offshore wind lease sales in Rhode Island, Virginia and Massachusetts.

We're also focusing our efforts on the demand side. Energy efficiency is one of the clearest and most cost-effective opportunities to save families money, make our businesses more competitive, and reduce carbon pollution.

We have established the toughest new fuel economy standards in U.S. history, which will approximately double the efficiency of our cars and trucks by the middle of the next decade. These standards will save the average driver more than $8,000 dollars at the gas pump over the lifetime of a model year 2025 vehicle, helping the United States to once again take the lead in developing, building and selling the world's most advanced cars. The Administration has also established first-ever fuel efficiency and greenhouse gas standards for heavy-duty trucks, buses and vans. The Plan commits the Administration to building on this progress with a second round of standards for heavy duty trucks, in order to reduce pollution, cut oil consumption, and save money for truck operators.

In addition, the Plan calls for setting greenhouse gas emissions (GHG) standards for new and existing power plants and Administrator McCarthy will discuss EPA's efforts to implement the Plan in her testimony.

The Plan also sets a goal to reduce carbon pollution through efficiency standards for appliances and Federal buildings by at least 3 billion metric tons cumulatively by 2030. That's the equivalent of reducing more than half of the carbon pollution in one year from the U.S. energy sector.

Since August, the Department of Energy (DOE) has issued five proposed energy conservation standards for appliances and equipment and finalized energy conservation standards for an additional product category. Savings from these rules if finalized as proposed, combined with final rules already issued under this Administration, would surpass 70 percent of the President's goal for emissions reductions from energy conservation standards. When combined with the other standards issued by this Administration, they will help cut consumers' electricity bills by hundreds of billions of dollars.

The Plan also expands the Better Buildings Challenge, which is focused on cutting energy use in commercial, institutional, and industrial buildings. Under the Challenge expansion announced last month, 50 new multifamily housing partners – representing roughly 200,000 units and over 190 million square feet – have committed to cutting their energy use by 20 percent in ten years.

At the U.S. Department of Agriculture (USDA), Secretary Tom Vilsack recently announced $250 million in new lending opportunities to help rural homeowners and businesses invest in affordable, cost-effective energy efficiency improvements and renewable energy systems through USDA's Energy Efficiency and Loan Conservation program.

As we work to support these new opportunities in the private sector, we're also focused on making sure the Federal government is leading by example. The Federal government is the single largest consumer of energy in the United States. Since 2008, Federal agencies have reduced their greenhouse gas emissions by approximately15 percent. Just over a month ago, the President directed agencies to redouble those efforts by consuming 20 percent of their electricity from renewable sources by 2020, more than doubling their current goal. The General Services Administration plays an important role in these efforts.

Preparing for the Impacts of Climate Change

Even as we make efforts to cut carbon pollution, we also need to take action to address current and anticipated impacts of climate change that cannot be avoided.

It is difficult to link a particular weather event to climate change, but we do know that as Earth continues to warm, we can expect more frequent extreme weather events, including large storms, severe droughts, and heat waves. These events can be destructive, contributing to conditions that result in catastrophic wildfires, storm surges, and floods, which in turn threaten the health and well-being of our people and our local, regional, and national economies.

In 2012, according to the National Oceanic and Atmospheric Administration, there were 11 weather and climate disaster events in the United States with losses exceeding $1 billion each. These 11 events cumulatively caused over $110 billion in damages and 377deaths.[1] Impacts of related changes in precipitation and temperature patterns include changes in the distribution of plant diseases and pests that threaten forest and crop production and changes in the distribution and migration of commercially important fisheries. It is simply irresponsible to ignore the toll that these and other climate change effects are taking on our country.

Last summer, the Administration released a Hurricane Sandy Rebuilding Strategy to help the Sandy-affected region rebuild and increase its resilience in order to reduce risks associated with sea-level rise and storm surges to vulnerable coastal communities. The strategy serves as a model for communities across the Nation facing greater risks from more frequent, extreme weather and other impacts of climate change. This means building for the next storm, not the last storm, and planning for expected future sea levels, storm surges and extreme heat and precipitation, which pose new risks to the Nation. As a part of these efforts, the Department of Housing and Urban Development and its partner agencies are investing in infrastructure that is safer and more resilient, and the Federal Transit Administration recently announced $3 billion in grants to similarly strengthen public transit systems affected by the storm.

In order to help prepare the Nation for the impacts of climate change, the President recently signed Executive Order 13653 directing agencies to help American communities strengthen their resilience to extreme weather and prepare for other impacts. Specifically, agencies are directed to modernize Federal programs to better support local preparedness for climate change impacts, manage our natural lands to improve resilience, and develop information, data, and tools to help communities and other decision makers By way of example, resource agencies are looking at how to make our lands and waters more resilient to climate impacts as well as how to use natural infrastructure, such as wetlands, vegetated sand dunes, and healthy forests, to bolster our communities in the face of extreme weather and other impacts. These efforts build on important steps we have already taken. For example, in early 2013, to help advance these types of efforts, the Administration along with States and Tribal governments completed the National Fish Wildlife and Plant Climate Adaptation Strategy to help safeguard the nation's valuable natural resources and the communities that depend on them.

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[1] http://www.ncdc.noaa.gov/billions/overview

The Executive Order also established a State, Local and Tribal Leaders Task Force on Climate Preparedness and Resilience, composed of 26 elected officials from across the country. The Task Force has already begun working to advise the Administration on how the Federal Government can remove barriers to climate change resilient investments; modernize Federal programs, grant and loans to better support local efforts; and develop the tools necessary to help communities prepare for climate change on the local level. As a co-chair of the Task Force, I believe these recommendations will be vital to ensuring the Federal government responds to the needs and priorities of communities when addressing the challenges of climate change.

Agencies are also analyzing the impacts of climate change on key sectors of our economy and developing strategies to address them. Last summer, the DOE released a report outlining the impacts of climate change on the energy sector, which included recognition of the damage Gulf Coast hurricanes are inflicting on offshore platforms, pipeline infrastructure, and refineries. On the Mississippi and Ohio rivers, shipping disruptions have occurred due to both high water floods and low-flow droughts. And in Nebraska, the Fort Calhoun nuclear plant had to curtail power production because of flooding problems. DOE has outlined strategies that could help address vulnerabilities like these in the future.

In November, we launched the National Drought Resilience Partnership, to help communities better prepare for increasing droughts to reduce impacts on families and businesses. The Partnership will make it easier to access Federal drought resources, such as monitoring, forecasts, outlooks, and early warnings, as well as longer-term drought resilience strategies in critical sectors.

Similar efforts to protect and strengthen economic sectors will focus on the public health, transportation, agriculture, and water resource sectors.

Finally, under this Administration, all agencies are examining how a changing climate will impact their missions. In February of 2013, Federal agencies released their first-ever Climate Change Adaptation Plans, outlining strategies to reduce their vulnerability to the impacts of climate change, such as sea level rise and more severe weather patterns. For example, during a period of record rainfall in June of 2006, the Internal Revenue Service's headquarters building was flooded and sustained extensive damage to its infrastructure. Costs for repairs were in the tens of millions of dollars, and it was necessary to close the building until December 2006 to complete them. Agency adaptation plans now highlight actions to proactively plan to avoid these impacts.

Leading Internationally

The President understands that the effects of climate change will not be confined within the borders of any one country, and our response must be global. In addition to our efforts under the Plan to reduce domestic carbon pollution and help our Nation's communities prepare for the effects of climate change, we are committed to playing a leadership role that can support a strong international response to this challenge.

The Administration is working through multiple channels, such as the United Nations Framework Convention on Climate Change, as well as multi-lateral and bi-lateral initiatives focused on tackling the key drivers of greenhouse gas emissions. Our leadership can leverage more ambitious action by other countries - and the faster other nations reduce their emissions, the more moderate the long-term climate impacts will be on our own citizens, communities, and businesses. That's why American leadership on climate pays dividends back at home.

Closing

The impacts of climate change are being shouldered by communities, families and businesses across our country, and my testimony today highlights just a few of the many efforts taken by the Administration to address the threat of climate change, while building a foundation for continued economic growth. I am proud of the steps we've taken. For the sake of our economy and the legacy we leave for our children, it's vital that we address this problem head on, and I think the President's Plan does just that.

I look forward to taking your questions.

Senator BOXER. Thank you very much.

And now we turn to Hon. Dan Tangherlini.

STATEMENT OF HON. DAN TANGHERLINI, ADMINISTRATOR, U.S. GENERAL SERVICES ADMINISTRATION

Mr. TANGHERLINI. Good morning, Chairman Boxer, Ranking Member Vitter and members of the committee. I appreciate being invited here today to testify on this important topic.

Last year, the U.S. Government Accountability Office added climate change to its high risk list, citing that it presents a significant financial risk to the Federal Government. According to the National Climatic Data Center in 2012, weather and climate disaster events caused over $110 billion in damage and 337 deaths, making it the second costliest year on record. The Administration is committed to reducing the damage caused by climate change and to preparing for its long term impacts. In June 2013, the President reaffirmed this commitment with a climate action plan that directs agencies to cut carbon pollution, prepare for the impacts of climate change and lead international efforts to address global climate change.

GSA is one of the many Federal agencies doing its part to assist in this effort. As the owner and caretaker of Federal properties, our large and diverse portfolio presents many opportunities to increase the Government's energy efficiency, reduce our contribution to climate change, save millions of dollars in energy costs, and to plan and implement risk management strategies. As part of the President's climate action plan, GSA is undertaking efforts to improve the efficiency of our Federal buildings, identify and prepare for climate risks, and is working to ensure that we share lessons learned with our partner agencies.

GSA reduces energy consumption across its portfolio through a variety of means. GSA leverages technology such as advanced metering, remote building analytics and smart building systems to uncover deeper energy savings opportunities. We also use rapid building assessments to perform sophisticated energy audits that require no onsite work or new device installations. Another valuable tool is energy savings performance contracts. These are public-private partnerships where the private sector provides the up front capital to make energy efficiency upgrades in a facility and is paid by the Federal agency from the guaranteed energy savings under the contract. Once the contract ends, the agency continues to benefit from the reduced energy costs.

The President's climate action plan sets new goals on the use of renewable energy, increasing the current goal from 7.5 percent to 20 percent by 2020. In fiscal year 2013, 46.1 percent of electricity procured or generated by GSA came from renewable sources, and enough renewable energy to power nearly 2,600 homes came from our own facilities.

GSA is also working to improve our partners' understanding of their energy use. As directed in the December 2013 Presidential Memorandum on Federal Leadership and Energy Management, GSA is partnering with the Department of Energy and the EPA to prepare and initiate a pilot Green Button initiative that will increase our partners' ability to manage energy consumption, reduce greenhouse gas emissions and meet sustainability goals.

Taken together, these efforts have led to a significant reduction in GSA's energy use intensity and greenhouse gas emissions. In fiscal year 2013, GSA reduced energy usage per square foot by 24.8 percent, ahead of statutory targets. Since fiscal year 2011, these reductions have saved $192.7 million in avoided costs. Also in fiscal year 2013, GSA achieved an approximately 50 percent reduction in greenhouse gas emissions, exceeding our 2020 target. This amount of energy that we no longer use is enough to power over 60,000 homes for 1 year.

GSA is also preparing for the potential impacts of climate change as part of the President's climate action plan. While it is impossible to predict the precise occurrence and cost of each and every climate risk, it is imperative to develop a robust risk management approach. The President's climate action plan represents a commitment to reduce and respond to the impacts of climate change. GSA is responsible for buildings and offices throughout the Government and across this country. This means we play a vital role in mitigating and preparing for these adverse effects. Through improved energy efficiency and risk planning, we hope to continue to make progress on both of these critical efforts.

I appreciate the opportunity to be here today and I welcome any questions you have.

[The prepared statement of Mr. Tangherlini follows:]

U.S. General Services Administration

Dan Tangherlini
Administrator

Senate Committee on Environment and Public Works
"Review of the President's Climate Action Plan"
January 16, 2014

Good morning Chairman Boxer, Ranking Member Vitter, and Members of the Committee. I appreciate being invited here today to testify on this important topic.

Last year, the U.S. Government Accountability Office added climate change to its High Risk List, citing that it presents "a significant financial risk to the federal government." According to the National Climatic Data Center, in 2012 weather and climate disaster events caused over $110 billion in damages, making it the second costliest year on record.

This Administration is committed to reducing the damage caused by climate change, and to preparing for its impacts, both in the long term as well as those we are already experiencing. In June 2013, the President reaffirmed this commitment with a Climate Action Plan that directs agencies to: cut carbon pollution; prepare for the impacts of climate change; and lead international efforts to address global climate change.

The U.S. General Services Administration (GSA) is one of the many Federal agencies doing its part to assist in this effort. As the landlord and caretaker of federal properties, GSA owns or leases 9,624 assets, which includes maintaining an inventory of more than 370 million rentable square feet of workspace, and preserving more than 481 historic properties. This large and diverse portfolio presents many opportunities for GSA to increase energy efficiency, reduce our contribution to climate change, save millions of dollars in energy costs and to plan and implement risk management.

As part of the President's Climate Action Plan, GSA is improving the efficiency of our Federal buildings, identifying and preparing for climate risks, and working to ensure that we share lessons learned with our partner agencies.

Reducing Impact on Climate Change –

GSA reduces energy consumption across its portfolio through a variety of means. GSA leverages technology such as advanced metering, remote building analytics and smart building systems to uncover deeper energy savings opportunities. Advanced meters, which provide real time energy use information, have been installed in 450 buildings, representing 80% of GSA's total electricity consumption metered. Continuous enhancements to the system, ongoing training of users, use of detailed historical data and expert modeling are all proven methods which are increasing energy efficiency at lesser cost.

GSA uses rapid building assessments to perform sophisticated energy audits that require no onsite work or new device installations. Such remote analytics have resulted in significant cost savings over traditional audits and have identified additional energy savings opportunities.

The President's Climate Action Plan also highlights other important tools we can use to improve the efficiency of our buildings, including continued use of Energy Savings Performance

Contracts (ESPCs). An ESPC engages the private sector in an agency's efforts to achieve energy efficiency improvements. The private sector provides the upfront capital to make energy efficiency upgrades in a facility, and is paid by the Federal agency from the guaranteed energy savings under the contract. Once the contract ends, the agency continues to benefit from the reduced energy costs. In December 2011, the President challenged Federal agencies to enter into a combined $2 billion worth of ESPCs by December 31, 2013. GSA exceeded its own target of $175 million with $191 million in contracts awarded. These contracts, which range from 12 to 23 years in duration, are projected to reduce GSA's annual energy consumption by 365 billion Btus, or about the amount of energy used in 3,380 single family homes per year, resulting in direct savings (lower utility payments) of $10.6 million per year.

The President's Climate Action Plan sets new goals on the Federal use of Renewable Energy, increasing the current goal from 7.5 percent to 20 percent by 2020. In FY 2013, 46.1 percent of electricity procured or generated by GSA came from renewable sources (nearly 1,200 GWh). Over 24 GWh of this renewable electricity was generated at our own facilities. GSA expects to generate nearly 29 GWh per year once on-site renewable projects currently underway are fully operational. This amount of on-site renewable energy is enough to power nearly 2,600 homes.

Through the use of Green Button data, the President's Climate Action Plan also highlights the importance of collecting data to promote better energy management. Green Button is an industry-led effort, in response to the Administration's call-to-action, that looks to meet the challenge of providing electricity consumers with secure, easy to understand information on their energy usage. As directed in the December 2013 Presidential Memorandum on Federal Leadership in Energy Management, GSA will partner with the Department of Energy and Environmental Protection Agency to prepare and initiate a pilot Green Button initiative at Federal facilities. Following the pilot, DOE, in coordination with EPA, is required to issue guidance on use of the Green Button standard at Federal facilities. GSA will leverage the Green Button standard within its federal facilities to increase the ability to manage energy consumption, reduce greenhouse gas emissions, and meet sustainability goals.

Taken together, these efforts have led to a significant reduction in GSA's energy use intensity and greenhouse gas emissions. In FY 2013, GSA achieved a cumulative reduction in energy usage per square foot of 24.8 percent,[1] ahead of statutory targets. Since Fiscal Year 2011, these reductions have saved $192.7 million in avoided direct energy costs.[2] Also, in FY 2013, GSA achieved an approximately 50 percent reduction in greenhouse gas emissions, exceeding our FY 2020 target.[3] That is the equivalent of more than 60,000 homes powered for one year.

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[1] Per the Energy Independence and Security Act of 2007, this reflects a reduction in "covered facilities" from a baseline of Fiscal Year 2003.

[2] Based on energy use consumption in FY 2003 multiplied by the current price of energy, subtracted from actual costs.

[3] Executive Order 13514 required Federal agencies to set a target for reductions to Scope 1 and 2 GHG emissions. In Fiscal Year 2010, GSA established a 28.7 percent reduction target from a Fiscal Year 2008 baseline.

Preparing for the Impacts of Climate Change –

GSA is also preparing for the potential impacts of climate change as part of the President's Climate Action Plan. While it is impossible to predict the precise occurrence and costs of each and every climate risk, it is imperative to develop a robust risk management approach.

One such area of focus has been preparing for future floods. GSA is actively coordinating with the U.S. Army Corps of Engineers (USACE), U.S. Global Change Research Program (USGCRP), Federal Emergency Management Agency (FEMA), National Oceanic and Atmospheric Administration (NOAA), and Federal Interagency Floodplain Management Task Force to incorporate the most recent and relevant flood-risk reduction strategies into GSA's operations. We are in the process of updating GSA's internal floodplain management guidance and are taking into consideration updated FEMA floodplain maps and additional guidance on using climate projections.

GSA is also working to boost the resilience of buildings and infrastructure. We are in the process of prioritizing our most mission critical and vulnerable facilities, looking into cost-effective climate-resilient investments, and investigating solutions that reduce both climate change risks and greenhouse gas emissions. A pilot project is currently in place to incorporate climate risk reduction factors into a new land port of entry facility. GSA will take lessons learned from this pilot and share with other agencies.

We believe these efforts will ensure GSA, and the Federal government broadly, is more prepared to address the long-term consequences of climate change.

Conclusion –

The President's Climate Action Plan represents a commitment to reduce and respond to the impacts of climate change. As a major landholding agency of the Federal government, GSA plays an important role in mitigating and preparing for these adverse effects. Through improved energy efficiency and risk planning, we hope to continue to make progress on both of these critical efforts.

I am pleased to be here today, and I am happy to answer any questions you may have. Thank you.

Senator BOXER. Thank you so much to our patient panel. We will start the questioning and comments.

Sometimes the more things change, the more they stay the same. Let's take the often-repeated charge that scientists are divided on climate change. Let's take a look at that. So we have quantified it. There are 98 percent of the scientists, I am sorry, I will correct myself, 97 percent of the scientists who say that human activity is causing carbon pollution. And there are 3 percent who fight that. So it is 97 percent of the scientists on one side and 3 percent on the other. And my colleagues act as if it is 50-50.

It is just like the scientists who are divided on whether or not smoking caused cancer. It was 97 percent to 3 percent and when you looked at the 3 percent, they were somehow connected to the tobacco industry. And I can tell you that most scientists who say no to climate change have ties to big oil and coal polluters, including the scientist who was mentioned here today by Senator Wicker. We checked it out. He is from a think tank that is funded by the Koch brothers.

So again, when people say there is a split, let's look at what the split is. Second——

Senator WICKER. Madam Chairman.

Senator BOXER. I am going to continue and then I am happy to call on you in your turn.

Now, there's also predictions of economic gloom and doom, gloom and doom if we address climate change and if we move to clean energy. We are already hearing about the money we are saving by going to energy conservation.

But let's go back 40 years. Forty years, when in this committee we had a robust debate, I wasn't here then, on the Clean Air Act. And it was gloom and doom, we were going to destroy the economy. Let's look at what happened since the Clean Air Act.

Over the last 40 years, our national GDP has risen 207 percent. The total benefits of the Clean Air Act amount to more than 40 times the cost of regulation. For every dollar spent we get $40 in benefits. So the gloom and doom that is always predicted when we move to clean up the environment keeps being repeated. Fortunately, the people don't believe it. Only the people here believe that. Too many. But the people out there, Republicans, Democrats, Independents, don't believe it.

Now, I want to ask Administrator McCarthy a question related to something that is very disturbing that has been said on the other side. And I believe my friends truly mean this, they are not, they are very, very concerned. And they are concerned that the President is acting by fiat, that he is above the law, that he is moving in a way that isn't warranted and that is up to the Congress to take action to move forward with new standards for existing power plants and so on and so forth.

So I just looked at the Supreme Court decision, there are two of them, one in 2007. And what they said then contrary to something Senator Sessions said, which he has a right to believe, he said that carbon wasn't covered. Well, the Supreme Court said that "The statute is unambiguous," and the Clean Air Act covers carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, without a doubt.

Senator SESSIONS. Madam Chair, you quoted my name, and——

Senator BOXER. You will have the time. You will have the time.

Senator SESSIONS [continuing]. Your interpretation of my remarks——

Senator BOXER. You will have the time. You can talk about me for an entire 5 minutes, I don't care. Now, could you set the clock back and give me another 30 seconds? Thank you.

[Laughter.]

Senator BOXER. Here we are. Clear Supreme Court case decision, followed by another one in 2011 that said absolutely, you have to move on these power plants.

So my question to you is, as you move forward with this, isn't it true that if you did not move forward with the climate action plan, if you did not try to regulate this carbon pollution which is so damaging and which is covered by the Supreme Court decision that you could be sued and you could be harmed if you didn't do that?

Ms. MCCARTHY. Madam Chairman, we actually have been petitioned and we are in litigation about regulating carbon pollution in a number of sectors. The most important thing to remember about the President's carbon action——

Senator BOXER. Sued because people think you are not doing enough?

Ms. MCCARTHY. That is correct.

Senator BOXER. Or because you are doing too much?

Ms. MCCARTHY. That is correct, because once you decide it is a pollutant under the law and that it endangers, EPA is obligated to look at those public health and environmental impacts and to consider those in their regulations.

Senator BOXER. So you are already being sued by those in the public who think EPA is not doing enough, while people here say you don't have the right to do anything, and the President has no right to do anything. It is very clear, if you read these cases, that you have to move forward.

Ms. MCCARTHY. But the President made the—I am sorry.

Senator BOXER. No, no, go right ahead.

Ms. MCCARTHY. But the President made the very sensible and common sense decision to tell us to focus on power plants first. Because power plants represent 33 percent of the carbon emissions that are being emitted in the U.S. and 60 percent of the emissions from stationary sources. So we are trying to be very deliberate and careful in how we apply the Clean Air Act.

Senator BOXER. I believe you are. And I would close with this, the endangerment finding was started under George W. Bush, and we got that endangerment finding, that draft, and it was completed under the Obama administration. So that was common ground.

I would call on Senator Vitter.

Senator VITTER. Thank you, Madam Chair. Administrator McCarthy, I am going to have 5 or 10 minutes talking with you, so I want to focus on all of these new, very consequential regulations. But I first want to ask that if this committee calls a separate hearing on the investigation and circumstances surrounding John Beale, and if you are invited to testify along with other appropriate witnesses, would you come and testify at that hearing?

Ms. MCCARTHY. Whatever the Chair wishes, sure.

Senator VITTER. Is it fair to say whatever the committee wishes, if it is a committee invitation?

Ms. MCCARTHY. If I am invited, I will always appear. Yes.

Senator VITTER. So you have no hesitation talking about that subject?

Ms. MCCARTHY. None at all.

Senator VITTER. Thank you.

OK, Ms. McCarthy, I want to focus on one area where I think there is a clear overstep, and that is the greenhouse gas new source performance standards. You have said as you relooked at that, "We did what democracy demands, we paid attention, we read those comments, we thought about them and we decided that we needed to update the proposal." Talking about the initial wave of comments that came in about that. And you further stated, "Our best defense is to do it right, to do it correctly under the law."

However, the Energy Policy Act of 2005 clearly prohibits EPA from considering certain federally funded projects when setting the standards. And yet three such projects form the majority of EPA's discussion regarding new plants. And there is no mention of EPA Act 2005 in the over 400 pages of that proposal.

Recent press accounts report that you and the agency were unaware of this conflict with the EPA Act requirement until it was pointed out by colleagues in the House of Representatives. How did the EPA miss this?

Ms. MCCARTHY. Senator, I will advise you that EPA is, understands that concerns have been raised about EPACT. To address those concerns we have very recently, I think as early as this morning, provided to OMB for interagency review a notice of data availability, so that the package is very clear about its intersect with EPACT. We believe that having this specific consideration for EPACT makes no change in the standard as we have proposed, but it is important that the public have this information and have us provide more clarity on that issue. That is exactly what we are doing.

Senator VITTER. Is all of this since the issuance of the new proposed rules, or did you consider that, did you evaluate that before the issuance of the new rules?

Ms. MCCARTHY. I can't say what the individual staff was aware of or not. I certainly was not aware that we should raise that issue specifically. We are going to address that issue specifically, but Senator, we are looking at evidence in data well beyond what has been associated with the EPACT funded projects. So we are very comfortable with the standard that we propose. We think it is a very robust data set. We are looking at those facilities in concert with all those, which is perfectly appropriate under EPACT.

Senator VITTER. Well, as you know, these three projects that under the law you can't consider, you clearly cannot consider, they form the majority of your discussion about the regs. So I think there is a serious problem there.

But let me go on. Let me just also point out, you said EPA read all the comments. San Miguel Electric Cooperative submitted comments and they underscored this particular issue. They pointed out, this law is in direct conflict with what you are doing, with your evidence, your support for doing this. So I just wanted to point that out.

This is very concerning, because this is a direct legal conflict. I think this concern is underscored by the fact that litigation has now been filed over this direct legal conflict, which is clearly, by EPA's own submissions and writing, the majority of its backing for these new source performance standards.

Ms. MCCARTHY. But Senator, our understanding of the reading of the EPACT is that we can't solely make a determination on the basis of EPACT funded facilities. There is nothing in the law that precludes us from considering those in the context of a larger, more robust data set, which is what we are actually doing.

Senator VITTER. OK. I want to move on to the social cost of carbon process. Many of us have written you and others at EPA, very concerned about this secretive process. We wrote you in September of last year, we wrote another one of your high-ranking deputies in November with detailed questions. We got a response at 8:18 a.m. this morning. I appreciate that. I think the timing of that response says a lot.

We are going to be, I am out of time, so we are going to be submitting detailed questions as a follow up to you and to the other witnesses for the record regarding the social cost of carbon process, because it is being used to justify all sorts of regulations, we believe, without adequate backing.

Senator BOXER. Thank you very much, Senator Vitter. Senator Cardin.

Senator CARDIN. Thank you, Madam Chair, and I thank all four of our witnesses, not only for their appearance here but for their public service and for your strong leadership on this issue.

Mr. Tangherlini, I want to ask you a question concerning one specific consolidation. But buildings play a huge role in dealing with the carbon emissions. We had the President take some pretty aggressive action so that the Federal Government is a leader in reducing carbon in our buildings. The Committee on the Consolidation of the FBI, our resolution makes it clear that to the maximum extent practicable the Administration shall require that the procurement include requirements for water and energy efficiency and stormwater management in accordance with the executive order. This is the largest public works consolidation probably in this decade. So it is one that we will want to be a clear example of what we can do to reduce carbon emissions.

But we also want to consolidate the FBI, because it is inefficient the way they operate, which is also causing excess energy use and a larger carbon footprint than we need. The committee is pretty clear when it says we want a consolidated headquarters facility, giving you up to 2.1 million rentable square feet and up to 55 acres. The Appropriations Committee just recently in its report accompanying the Omnibus Appropriation Bill made it clear that the FBI headquarters consolidation is expected to result in full consolidation of the FBI headquarters.

Can you assure this committee that passed the resolution that you will be in full compliance with both the environmental issues as well the plan that is ultimately selected? And that is going through a competitive process, which I certainly full understand. But it will provide for the full consolidation of the FBI.

Mr. TANGHERLINI. That is definitely our interest, Senator Cardin, as you point out. Having these employees spread out over more than two dozen facilities is not helping the ability of the FBI to meet the needs of that agency, but certainly causing undue expense because of rent, but also undue damage because of the additional environmental impacts. It is our interest to consolidate fully the FBI. We also though have to see what resources are available to us through the exchange process and what resources we would have to be able to bring into the project.

So as we have talked about, we are at the beginning stages of identifying the value of the current facility, identifying sites, completing a fair, transparent, competitive process.

Senator CARDIN. And I fully support that. I would just be pretty clear about this, I think it is pretty clear that Congress expects full consolidation and that that is not able but I would hope that you would work with Congress rather than—we expect full consolidation. Let me just put it that way.

Mr. TANGHERLINI. Absolutely.

Senator CARDIN. Let me just make one observation, Madam Chair, the point that you raised on the Administration's actions on the regulatory front which are required to do and they are doing absolutely the right thing in regulating carbon emissions. We tried a few years ago to pass a different framework, framework that would give more flexibility, set a cap and then give flexibility on how to reach those caps that would be an alternative to the regulatory process under the Clean Air Act. We couldn't get that done. Our friends on the other side of the aisle decided that that was not to be how they wanted to move forward.

And clearly the American people want clean air. And clearly the American people want a clean environment. And the Clean Air Act is critically important and you have a responsibility to carry out that law. And we should help you. We should help you. We try to do that. And we didn't get cooperation, and now we are getting complaints.

So I would hope that we will find ways to find that common ground, Mr. Ashe, that you quoted one of the members of this committee that I don't want to quote because it will just take my time.

But let me in the 40 seconds that I have remaining, the failure to deal with this causes us to concentrate on adaptation and resiliency. Significant resources have now been made available through the Sandy appropriations, et cetera. You talk generally about it, but could you supply us with specific programs that you are dealing with under your jurisdictions to deal with resiliency and adaptation in light of the realities that we now have a different climate pattern?

Ms. MCCARTHY. Let me be very brief, because I think others might want to interject. But all of the agencies have developed climate adaptation plans that have been publicly commented on. We are taking those plans to develop implementation strategies. But clearly EPA has a number of issues that are impacted, a number of concerns that are impacted by climate. Most notably certainly water and wastewater infrastructure issues. Those are of primary importance and raise the concern about moving toward green infrastructure, which keeps water local and can help provide more livable and safe communities.

Mr. ASHE. I think for the Fish and Wildlife Service, Senator Cardin, I think probably the most significant relevant piece is, we received $102 million under the Sandy supplemental funding for resilience, and to look at building resiliency into that middle Atlantic coastline as we do restoration from Hurricane Sandy. So it provides us really for the first time the opportunity not just to rebuild, but to rebuild in a way where we are thinking about making that, making our coastal infrastructure and our natural, our human and natural infrastructure more resilient in the future.

Senator BOXER. OK, we are going to move on to Senator Inhofe.

Senator INHOFE. Thank you, Madam Chair.

Ms. McCarthy, in my opening statement I brought up something that I have talked to you about before. That is, it just seems to me that it is, the delay of placing it on the Federal Register until January was done for the political purpose that I outlined. You can remember and I can remember back in 2012, prior to the election, I named all the different rules and regulations and how damaging they would be, would come out. So this is not a new issue with me. I just would ask you, is there any time that during this process that you or the EPA had a conversation with the White House or OMB in terms of the timing of the release on the Federal Register?

Ms. MCCARTHY. Senator, I will assure you that as soon as that proposal was released, we had submitted it to the Federal Register office. The delay was solely the backup in the Federal Register office. And we frequently asked when it was going to come out and how quickly. Because it was available on our web page, we wanted to start the formal public process.

Senator INHOFE. But if you started it, wouldn't that start the clock running for the 12-month period?

Ms. MCCARTHY. It would have started it an obligation on the part——

Senator INHOFE. Let's assume that for any reason, if you submitted that to be placed on the Federal Register, wouldn't that start the 12-month clock running? I am asking because I don't know.

Ms. MCCARTHY. It would have started the obligation under the Clean Air Act that says we should complete NSPSs within the 12-month period.

Senator INHOFE. So that would actually end up then in October, as opposed to in January in terms of when it actually comes out.

Ms. MCCARTHY. Senator, we had every opportunity to put out a reproposal, and we wanted, we tried very hard to get it published so that we could start that in the public process.

Senator INHOFE. OK, that gives us somewhere to go and look at.

I want to mention one other thing, too. Under the uninsured, unemployment insurance bill, I had an amendment that kind of reemphasized Section 321(a) of the Clean Air Act, and you are familiar with that, that is the one that says the Administration shall conduct continued evaluations of potential loss or shifts of employment which may result from the administration and the enforcement of the provisions of this chapter and application of implementation plans. It goes on, and it is very specific that the reason for this is they want to make sure, or we wanted to make sure way back in 1977 that if this took place, these various regulations, not knowing who would be in office in the future, that we would know what effect they have on jobs. And this is something that I do feel that we will, you can comply with section 321(a), in spite of the fact that my amendment didn't pass.

Ms. MCCARTHY. We are actually doing the best we can to do a complete economic analysis. When we do our major rules, we do look at employment impacts to the extent that peer-reviewed science and modeling allows. Because of Senator Vitter and his efforts to have us relook at whole economy modeling, we are pulling together an expert panel under our science advisory board to continue to look at these issues and to mature that science as best we can.

Senator INHOFE. That is good. But can we say that we would not implement these rules until we have that information?

Ms. MCCARTHY. We actually provide a significant amount of information. Whole economy modeling is appropriate for some rules and not others. So we believe we are complying with that potion of the Clean Air Act at this point.

Senator INHOFE. And from this point on, and maybe you have done it in the past, but from this point on can we really that we are not going to be activating these regulations until such time as we know the effect it will have on jobs and the economy?

Ms. MCCARTHY. Senator, what you can be assured of us when we do rules we will do it to the full extent that the science is available and the analysis can be done in a way that is consistent with all the requirements at OMB.

Senator INHOFE. Well, that is good. I appreciate that. We will be looking for, as the clock moves on, to make sure that is being done.

Mr. Ashe, first I want to thank you on the record again for all the cooperation you have been on your word to approve the range-wide plan on oil and gas, CCAA, of the lesser prairie chicken. We have talked about this for a long period of time. You were kind enough to make two trips, not one but two trips out to Oklahoma, talk to these stakeholders and again, I just appreciate it very much.

I know Senator Udall, who I thought was here earlier, he may have mentioned this, Senator Udall's State and mine are working very hard to enroll acreage into the program so that it can successfully conserve the species in a way that is voluntary. It is just this whole idea, like the partnership program that I am so fond of, it doesn't assume that the stakeholders don't want to clean up their system and protect endangered species. Do you think that range-wide plan can ultimately preclude the need for listing under the Endangered Species Act?

Mr. ASHE. Senator, I think I met with the members of the range-wide partnership 2 weeks ago in Texas, and I think they are poised to make some significant steps forward. They already have signed up I think between a million and a half and two million acres of oil and gas lands, and they are working on the possibility of several million more. So the question is, can the implementation of the range-wide plan potentially address the threats to the species? Yes.

It can potentially. Will it? I think it is a question of performance. And I think we have a little bit of time left to see if that will work.

Senator BOXER. Sorry to cut you off, but we have gone over quite a bit.

We are going to turn to Senator Whitehouse.

Senator WHITEHOUSE. Thank you very much, Chairman Boxer.

Let me first say to my colleagues on the other side that as we solve the problem of carbon, I am prepared to accept that there are going to be economic impacts on families that you are here to represent. And it is important that in our solution we address that concern. Because that is a legitimate concern.

What I can't accept is that the coal and oil jobs are the only jobs that are at stake in this discussion. Not when fishermen in Rhode Island are no longer catching winter flounder because Narragansett Bay is 3 or 4 degrees warmer in the winter. Not when the ski season in the northeast, and frankly all the way out to Utah, is shortened. Not when foresters in Oregon and across the west are losing their jobs to the pine beetle and to the loss of having a vibrant national forest. Not when we have the kind of impacts that we are seeing throughout the economy. And that is just the economic impacts.

We also have health impacts in Rhode Island, as asthma and other conditions increase. We are losing our State at the coastal verge. The houses at Roy Carpenter's beach are falling into the ocean. I am not going to ignore those factors out of a desire to protect coal and oil jobs. I will work with you to a solution that solves our mutual concerns and helps those industries. But I am not going to ignore this problem.

The suggestion that climate change has stopped, I think, flies in the face of realistic evidence. If you take a look at what is happening and when that claim is made it refers to surface atmospheric temperature, one specific measure. But if you actually look at a trend line plotted, which is a mathematical thing, it is not debatable, it is something that mathematicians do all the time, you plot a trend line through the data and that is what you get. It is clearly going up. There is absolutely no legitimate dispute about that.

What you can do is you can cherry pick. And that is what some of our friends are doing. You can pick different periods in that rising step process. And if you pick a certain period, it will look like it is flat through that period.

But it doesn't last. The underlying trend is upward. And step after step after step is always up. There are in this graph one, two, three, four, five, six separate occasions when a denier could say that climate change isn't happening because it has gone flat and every single time they would have been wrong.

In light of that, I will ask Ms. McCarthy, on the spectrum between wisdom and recklessness, where you put placing a bet that this evidence shows that climate change has stopped and that we should stop worrying about carbon?

Ms. MCCARTHY. Climate change is happening, and I have been worried for a while.

Senator WHITEHOUSE. And one of the reasons that might explain this is when you look at what is actually happening in climate change, the carbon pollution is hitting our oceans pretty hard. Thirty percent of the actual carbon goes into the oceans. And when it does, it changes it, and that is why Senator Merkley has talked about the wipeouts of the oyster hatches in his State. Because acidified water came in, in which oysters could not build shells. Thirty percent of the carbon, 93 percent of the heat, 93 percent of the heat. The atmosphere, 2.3 percent of the heat.

So if anything changes just the tiniest bit in the ocean, imagine what effect that has in the atmosphere. Something is happening that creates that long-term trend oscillation that creates those steps that if you cherry pick them, can create the false impression that this thing has stopped. But if you really look at the problem, you have to look at the role of the oceans. And I am telling you, from the Ocean State, it is very hard for me, let me ask, does anybody on this panel doubt that the oceans are in fact warming? That sea levels are in fact rising, and that the ocean is in fact becoming more acidic? Indeed, is there a legitimate scientific debate on those three subjects? There is none, correct? There is none. The record will reflect that there was unanimous agreement from the witnesses.

Senator SESSIONS. The record will reflect nobody spoke up.

[Laughter.]

Senator WHITEHOUSE. OK, let's go ahead and have them all say it, if that is what the Senator wants.

Mr. ASHE. I don't believe on those points that you raised there is, those are based on observations.

Senator WHITEHOUSE. It is measurement, not theory, correct? Does everybody agree it is correct? Speak now, or else I am going to count you as yes. I am trying to save time here.

Ms. MCCARTHY. We agree.

Mr. TANGHERLINI. And I defer to my colleagues who actually know something about the subject.

Senator WHITEHOUSE. General Services Administration is not expert in this. I can appreciate that.

Last question. A ton of carbon that is released from a power plant, does that do more or less harm than a ton of carbon that is released from a refinery, a kiln or a boiler?

Ms. MCCARTHY. Same.

Senator WHITEHOUSE. Same. So at some point, we should probably start looking at refineries, kilns and boilers that release tens of thousands of tons of carbon as well?

Ms. MCCARTHY. Point taken, Senator.

Senator WHITEHOUSE. Thank you.

Senator BOXER. Thank you, Senator.

We are going to call now on Senator Barrasso. I am going to give the gavel to Senator Whitehouse while I step out for just a moment.

Senator BARRASSO. Thank you, Madam Chairman.

Ms. McCarthy, I would like to follow up on what Senator Vitter had asked on carbon capture and sequestration and your new proposed rule for new coal-fired power plants. This week a Bloomberg news story ran entitled EPA Assertions on Carbon Capture Viability Sparked Concerns by White House Officials. The article quotes from interagency comments prepared by the White House Office of

Management and Budget. The article quotes the White House OMB as saying about your new rule that "EPA's assertion of the technical feasibility of carbon capture relies heavily on literature reviews, pilot projects and commercial facilities yet to operate." It goes on to say "We believe," this is the White House saying "We believe this cannot form the basis of a finding that CCS on commercial scale power plants is 'adequately demonstrated.'" And as you know, and as was stated before, the law requires that emission control performance standards must be "adequately demonstrated."

So the White House is saying that carbon capture sequestration is not adequately demonstrated that you are recommending. So my question is, what does the White House know that you haven't acknowledged? And is the agency going to speak more definitely on this topic?

Ms. MCCARTHY. Senator, I don't know what you are referring to, but you can be assured that this proposal went through interagency review. You can be assured that OMB cleared the proposal. And I am very confident that you will see that CCS is proven to be technically feasible in that data that we have provided.

Senator BARRASSO. I am just going to have to disagree with you. The White House apparently disagrees with you as well through the OMB. And it is not just one person who is making that comment. If you take a look at other testimony in the House from Assistant Secretary of Fossil Energy in the Administration testifying that commercial technology currently is not available to meet the EPA's proposed rule, the cost of current carbon dioxide capture technology is much too high to be commercially viable, places the technology at similar economic thresholds of alternative clean carbon. And it just goes on and on about the lack of viability and availability of what you are proposing. It just seems to be a level of denial by the EPA as to what is actually available, and the White House seems to have called you on that. So I would be interested, again, on your getting back to me on the specifics as you look into it some more.

I would like to read from a story from yesterday entitled E-mails Show Extensive Collaboration between EPA, Environmentalist Organizations, Top Officials Coordinate Messaging, Help Groups Gather Petitions. The article stated that Deputy EPA Administrator Bob Perciasepe attended an April 24th, 2012 meeting with 24 leading environmentalist groups, including the Environmental Defense Fund, the Sierra Club, Natural Resources Defense Council, according to a notice of the meeting sent by his assistant, Terry Porterfield. The article quotes EPA employee Porterfield's e-mail to the environmental groups. The e-mail says "The purpose is to create a photo op and narrative beat for the comment-gathering efforts on the issue," Porterfield wrote. "Groups will use materials from the event to communicate with supporters and recruit additional comment signers via newsletters, e-mails and social media."

Is this the standard practice of the EPA, to work with environmental groups to coordinate on getting comment signers that are favorable to your proposed policies?

Ms. MCCARTHY. It is very common practice for EPA to meet with a variety of stakeholders. Our agendas and our meetings are public. I think if you look at the history of EPA, we meet as much with industry groups as we do with environmental groups. It is our job to understand what concerns people have and how we can work with them to make sure we are doing our job appropriately.

Senator BARRASSO. This doesn't sound like you are looking for input, though. These e-mails that have been found seem to say your goal with meeting with these specific groups is to recruit additional comment signers via newsletters to generate support for positions that you are taking and some of those most liberal of all environmental activist groups, rather than actually bringing in input.

Ms. MCCARTHY. I am happy to take a look at that, Senator. I haven't read the e-mail, I don't know what it is referencing. But there are often times when we have groups that come in and give us petitions.

Senator BARRASSO. Is it proper behavior for the EPA to go out with these groups for the sole purpose of recruiting additional comment signers to then go ahead and support your position?

Ms. MCCARTHY. I certainly don't want to interpret what you just read, Senator, I don't know what the occasion was. I am sorry.

Senator BARRASSO. Do you believe it is proper activity on behalf of the EPA?

Ms. MCCARTHY. It is appropriate for EPA to connect with all of our stakeholders.

Senator BARRASSO. Thank you, Madam Chairman.

Senator BOXER. Senator Carper.

Senator CARPER. I would just say to my colleague, I mentioned, I don't know if you were here, the North American Auto Show, a place I have gone for many years, a long time, built more cars, trucks, vans per capita than any other State. We had a Chrysler plant, a GM plant, we lost them both, within months of each other, just a few years ago. I still go to the Detroit Auto Show, and I was very pleased to see EPA represented there. As you know, a major source of air pollution in our country is our motor vehicles. Some people might criticize and say, why would you go the North American Auto Show? It is because some of the folks that are most important for our economy, and frankly, people that they need to be not just regulating but having a conversation with were there, were there, from the top leadership of these companies all the way down. That is the kind of thing I commend you for doing and I hope you will continue to do more of that. I think you would have been encouraged by that, had you been with us. I want to invite you to go with us next year.

I have a question, maybe just one or two here. Administrator McCarthy, with respect to new source performance standards, I just want to take a minute or two to focus on EPA's efforts to implement carbon pollution standards for power plants. We call this new source performance standards, as you know. I believe Congress established new source performance standards in the 1970 Clean Air Act. It is nothing new. And your agency has had a long history of implementing this standard. Is that correct?

Ms. MCCARTHY. That is true.

Senator CARPER. Can you tell us what the agency's experience has been with these types of standards? How has the agency worked with industry and stakeholders already and expects to do so into the future when it comes to these greenhouse gas standards? Third part of the question is, what has EPA's past experience been when determining what is adequately demonstrated technology when determining new source performance standards? Those questions, thank you.

Ms. MCCARTHY. Well, Senator, thanks for the question. First of all, the Agency has had a long history in developing new source performance standards. We have done dozens and dozens of industry sectors. There are two types. One is looking at new facilities and it is very clear that it is intended to make sure that we continue to develop advanced technologies moving forward, so we take advantage of the best and brightest technologies and move our innovative technologies more broadly into the market.

The work that we do in existing facilities has also been very robust. Our challenge there is to make sure that we work with States to develop guidance and then they develop plans to do their job. We have had, when I looked at these standards, the standards that, the proposal that we put out for 111(b), which is new sources, it was done exactly the same way that we have done dozens and dozens of those. We looked at the data available, we looked at the technologies, we made a determination that CCS was the best system for emission reduction for coal facilities moving forward, because it was technically feasible, it would amount to significant emission reductions. And it would continue to effectively promote the development and deployment of advanced technologies.

So we did it the same way we always do, which for a long time we have been doing very successfully and businesses continue to grow.

Senator CARPER. All right, thanks.

A question if I could for Ms. Sutley. I think you mentioned in your testimony when I was out of the room, the President's task force on climate preparedness and resilience, in which Governor Jack Markell is a participant, as you may know, how do you expect the valuable information collected from this task force will be passed down and implemented throughout our Federal Government?

Ms. SUTLEY. Thank you, Senator. The President directed us to establish a task force of State, local and tribal elected leaders, and we are grateful to have the participation of Governor Markell. This is a very important task force for us in helping to ensure that the kinds of policies and programs that the Federal Government as a whole is considering in terms of making sure that we are prepared and resilient in the face of the changing climate will help States, tribes and municipalities to prepare their communities to deal with the impacts of climate change.

We had our inaugural meeting and a lot of good ideas and we are having a second one very shortly, looking at different subject matters. We started out looking at disasters and resilience preparedness, we will be looking at infrastructure next. So the input and the recommendations that we gather from that group will be very helpful in helping us to look, governmentwide, through our resilience council at the things that the Federal Government can do, not only to prepare the Federal Government to deal with the impacts of climate change and the impacts on emissions, facilities, but also to ensure that our communities are prepared.

Senator CARPER. My time is expired. Mr. Tangherlini, very nice to see you twice this week, and Gina as well. Again, nice to see you again. Thank you all for your testimony and for the good work that you are doing. God bless. Thanks.

Senator BOXER. Senator Sessions.

Senator SESSIONS. Thank you, Madam Chair. I would certainly agree with the 97 percent as you framed it, that human action has caused more CO_2 to be emitted into the atmosphere. I don't doubt that one bit, and I don't think any scientists do. But in Congress, in 1974, when they passed the Clean Air Act, did not prohibit carbon dioxide. Global warming was not considered at the time, I don't believe any debate considered that question. It came before the Supreme Court, and what the Supreme Court said, Ms. McCarthy, is that the EPA should have to make an endangerment finding. You have made that endangerment finding. That was a five to four decision, by the way, only five to four, and it is coming back before the Court. And you are going to have to justify why plant food, CO_2, is a pollutant covered in 1974. And I would note, Congress has never since then ever passed legislation that prohibits CO_2 into the atmosphere, directly doing so. And Senator Whitehouse produced a chart which showed surface temperature data, which he described as surface atmosphere. But I am not sure whether—but what the IPCC models use, what scientists have referred to over the years at atmospheric temperatures are taken at the lower troposphere. This is what our chart shows, the kind of data we show, that the models aren't reaching the temperature increases on that that is predicted there. Haloes of heat around many land stations that record temperatures and they are not accurate, as accurate as the troposphere temperatures. That is what the IPCC recognizes.

Second, the chart suggested 93 percent of the heat is absorbed by the oceans, but it doesn't answer the question about how the amount of temperature change in the oceans. Evidence on panel will suggest the oceans may have warmed, but only by 5/100ths of a degree over the last 50 years. That is the chart Dr. Dessler will offer, and he is a Democratic witness who will be testifying here today.

And Mr. Ashe, you stated, more than your written statement says, that we have had more storms in America. And if we don't have common ground, if we are going to be able to reach and discuss issues together, we have to agree on what the problem is, and we have to be honest about the facts. Dr. Pielke testified here just a few months ago, supports President Obama, this is what he found about disasters and storms: "It is misleading and just plain incorrect to claim that disasters associated with hurricanes, tornadoes, floods or droughts have increased on climate time scales either in the United States or globally." You said directly opposite that.

Have you conducted any investigation yourself of storms and disasters? Have you done an independent review of that? Yes or no. I presume you haven't.

He went on to say globally, weather-related losses have not increased since 1990. He said U.S. hurricanes have not increased in frequency or intensity since 1900. He said that since at least 1950, the intensity and frequency of floods in the United States has not increased. He went on to say the frequency and intensity of tornadoes has not increased since 1950 and droughts have not increased globally for half a century. So do you still stand by your testimony? Have you done independent research to that effect?

Mr. ASHE. I am not a researcher. I have not done independent research, Senator. I think what I was speaking of in my testimony, in my oral testimony, is observation.

Senator SESSIONS. Well, I would just say that I hope you will review that and be accurate when you discuss as a public official the facts, when you relate them to the American people. And I believe your facts are wrong.

Now, Ms. McCarthy, the President has said that we have had, repeatedly, at least three times in recent months, that the temperature around the globe is increasing faster than was predicted 10 years ago. I have written you about this. Is that accurate or not?

Ms. MCCARTHY. I do know some of the facts that I can provide for you.

Senator SESSIONS. No, I'm just asking you, is that an accurate statement? Has it increased faster than predicted or not?

Ms. MCCARTHY. I do not know what the President's context was for making that. I do know that if——

Senator SESSIONS. Well, do you believe the temperature has increased faster than predicted? Do you believe that the temperature in the United States has increased faster than predicted in the last, worldwide, than 10 years ago?

Ms. MCCARTHY. I believe that 2010 was the warmest year on record ever, and I believe that 2012 was the warmest——

Senator SESSIONS. Now, I want to know whether or not you believe that data shows that the temperature around the globe is increasing—please let me ask you, do I not have the right to ask the director of EPA a simple question that is relevant to the dispute that is before us?

So I want to ask, is the temperature around the globe increasing faster than was predicted even 10 years ago?

Ms. MCCARTHY. I can't answer that.

Senator SESSIONS. Why can't you answer that?

Ms. MCCARTHY. Because it is a narrow statement and a very large wealth of evidence and information.

Senator SESSIONS. Do we not have the troposphere temperature reports that even IPCC recognizes and do they not show that it is not increasing anything like what the predictions were? Can you answer that question?

Ms. MCCARTHY. Senator, I don't dissect the information and provide it to you in a way that claims that I am a scientist and it is a valid way to look at it.

Senator SESSIONS. You are asking us to impose billions of dollars of cost on this economy and you won't answer the simple question of whether it is an accurate statement or not?

Ms. MCCARTHY. I just look at what the climate scientists tell me. I don't dissect that information in ways that would impress you, but certainly I am not qualified.

Senator SESSIONS. Not me. Climate scientists are telling you it is not warming to the degree predicted, in fact, it hasn't really warmed at all in the last 15 years.

Thank you, Madam Chairman, my time is up.

Senator BOXER. I am going to give everybody an extra 2 minutes like I gave Senator Sessions. So you are going to get 7 minutes. Senator Fischer, Senator Boozman, and then we will each have an extra 2 minutes to close.

Senator FISCHER. Thank you, Madam Chair. I hope I won't take that amount of time, since we have another panel today.

Senator BOXER. We are happy to have you do it.

Senator FISCHER. Thank you.

Ms. Sutley, you spoke about the United States should have a global response because we are facing a global problem. In your testimony you mentioned working through the United Nations. What specifically can you tell us that the Obama administration is doing in that regard, and working through the United Nations, in your words?

Ms. SUTLEY. We participate in the U.N. Framework Convention on Climate Change, which involves, I believe, over 190 countries. The U.S. continues to be a participant in that, and the current activities are around developing an agreement for post-2020, addressing climate change with the aim of reaching an agreement in 2015 about what that might look like. So the United States as many other countries is engaged in those discussions right now.

Senator FISCHER. What I am looking at are specific actions. You say that to leverage more ambitious action by other countries that the Administration needs to step forward. I know it is always helpful to work with other nations, it is always helpful to have conversations. But I want to know specifics. What are we doing to help other nations? Are we investing resources? Are we providing scientists? What are we doing? And what is involved in the cost? Or are we just in conversations right now?

Ms. SUTLEY. There are a number of different efforts underway, both bilaterally and multilaterally, addressing a number of the drivers of climate change. For example, and perhaps the Administrator can talk a little bit more about this, working through existing international forums to deal with hydrofluorocarbons, which have a global warming potential as well as working on issues around clean energy and promoting clean energy and technologies around the world.

Senator FISCHER. Perhaps you and the Administrator could provide me with some examples, and if there are costs involved, I would be interested in knowing that as well.

Ms. SUTLEY. Yes, certainly.

Senator FISCHER. Thank you very much.

Also, Ms. McCarthy, the EPA regulations on coal-fired power plants are required by law to be technologically viable and commercially available. While EPA has insisted publicly that carbon capture and storage technology is technologically viable, there is serious doubt that EPA officials actually believe this to be true.

I am going to highlight a 2012 e-mail exchange that was produced through a Freedom of Information Act request between John Coequyt, head of the Sierra Club's Beyond Coal campaign, and EPA's Michael Goo and Alex Barron, both in the agency's ops policy at the time. Coequyt forwarded an article to Goo and Barron regarding your comments on proposed CCS regulations. In the article you were quoted as saying, “While it is a significant economic lift, the proposed standard will provide investment for new technologies. CCS is technologically viable.”

The headline then read, Coal To Remain Viable, says EPA’s McCarthy. In forwarding this article to EPA’s Barron and Goo, Mr. Coequyt wrote, “Pants on fire.” Do you have any idea why he would say pants on fire? We all know the saying that goes with that. Do you have any idea what that supposedly is about?

Ms. MCCARTHY. No, I don’t.

Senator FISCHER. Do you stand by your statement that, I believe you said it earlier today, that the CCS is viable?

Ms. MCCARTHY. Very much so.

Senator FISCHER. The EPA redacted Barron’s very brief comment then to Goo in response to another article 5 months article from Politico, with the headline Will EPA’s Greenhouse Regs Wipe Out Coal. And EPA did redact that comment, apparently no more than three or four words in total on the media article, as deliberative, which on its face is a curious use of that process exemption, to keep information from the public under the Freedom of Information Act. By doing so, EPA nonetheless indicates that it is deliberating whether its climate regulations will wipe out coal. I think the American public deserves to know, does EPA believe that the CCS is viable? Again, could you answer that?

Ms. MCCARTHY. Senator, when I was Assistant Administrator, I believed that the information supported that CCS was viable and was appropriate as a basis for that system of emission reduction. As Administrator, I retain the same assessment of the facts.

Senator FISCHER. Can you tell me why that e-mail was redacted?

Ms. MCCARTHY. I have no idea, Senator. I have no idea.

Senator FISCHER. Could you look into that and provide me with a copy of that e-mail?

Ms. MCCARTHY. I certainly will look into the issue. If they were appropriately redacted, then that is fine. But I certainly understand that there may be questions raised. But there is a lot of jibber jabber in an agency that is that large. But I want to assure you that the policy, the people making those policies and making those technical judgments were the people that were investing their time and providing input into this rule.

Senator FISCHER. I know we all receive e-mails and we have no control over that. But it is disconcerting when information like that does become public and then we have a Government agency going through a process of really blocking that freedom of information that I would hope would clarify statements like this. So I look forward to seeing that.

Ms. MCCARTHY. Senator, we certainly want to be as forthcoming as we can. It is an issue that has come up before on this committee. We will do our best job to provide you these e-mails, regardless, and only redact when it is appropriate to do so.

Senator FISCHER. Thank you so much.

Senator BOXER. OK, that was 7 minutes, and Senator Boozman, you have 7.

Senator BOOZMAN. Thank you, Madam Chair.

There was some criticism about a person that had done a study that was funded by the Koch brothers. I guess my problem with that is, you look at the product and then it is peer-reviewed and this and that, and you criticize it based on the work. Do you all ever use studies that rely, that are being done by environmental groups, funded by environmental groups? Is that a criterion for you as to whether or not it is a good paper or bad paper?

Ms. MCCARTHY. We actually look at the study itself and try to look at whether the analysis is correct and whether the science is strong.

Senator BOOZMAN. I think all of you have people that have worked for environmental groups in the past, different Administrations, but environmental groups. And the idea that you can produce a product, in fact we have witnesses coming up that are funded by outside groups one way or the other. But the idea that testimony or a paper can't be produced because you are a consultant for a various entity or whatever I think is really not a good situation. We really need to push back from that.

The other thing is, and in regard to just studies in general, it is really hard, we really do want to be helpful in the sense, we have some real problems to solve in the environment. It is helpful, though, it is difficult to do that if you don't have access to the materials and the scientific studies that allow you to make really wide sweeping decisions in that regard.

So will you commit to us that we will have those studies available so that we can see what the basis of your rationale is?

Ms. MCCARTHY. Senator, I assume you are talking to me?

Senator BOOZMAN. Yes, ma'am.

Ms. MCCARTHY. We have been providing information to the extent that we have it, we have already provided information that you have requested.

Senator BOOZMAN. OK. So the studies that we would like and this and that, you will give us those completely?

Ms. MCCARTHY. To the extent that they are in the control of EPA, of course, and to the extent that we can work together on those, we are more than happy to do that.

Senator BOOZMAN. Senator Whitehouse talked about the oceans, which are having some real problems right now, and the result to the fishermen. Is it your opinion that if we did pass the policies that the President is proposing, that you are proposing, would that solve the problems of the oceans that he is describing?

Ms. MCCARTHY. Me again? Oh, I am sorry. I keep thinking you are looking at me.

Senator BOOZMAN. I am sorry.

Ms. MCCARTHY. Climate change is a global problem. It requires global solutions. There is no question that international effort is required. The issue is, should the United States take action on its own that it can do that makes sense, that can be cost effective and that will help us grow economically. I think the President indicated that that answer is yes.

Senator BOOZMAN. But the reality right now is, in order for that to be effective, we are depending on the Chinese and the Indians and people like that who basically have said that they are not going to participate. Mr. Ashe.

Mr. ASHE. First of all, with regard to what Senator Whitehouse said, I think that when we look at natural resources like the ocean resources, that we have to realize that climate change is an overarching effect. So it exacerbates many problems that already exist within fisheries management and wildlife management, problems of habitat fragmentation and degradation and contaminant loading and invasive species. So it adds another layer of stress. So I think the things that we are talking about in terms of dealing with climate change will help address a major source of uncertainty and disruption in those systems and will certainly help secure our fisheries resources for the future. I think it is an important step for us to take to learn more and reduce the level of uncertainty surrounding this issue.

Senator BOOZMAN. Ms. McCarthy, are the models that were relied upon in developing the social cost of carbon estimates published and available on EPA's Web site?

Ms. MCCARTHY. I don't know the answer to that question, Senator. I can get back to you. That was work that was primarily organized by the Office of Management and Budget, so that work was not a product of the EPA, although I am sure our technical and economic folks participated in those discussions. I do know they are available, they are public, the models are public and they have been appropriately peer-reviewed.

Senator BOOZMAN. OK, so the part that you did, the EPA, it is not available on the Web site either?

Ms. MCCARTHY. Any work that EPA would produce would be publicly available for sure. I just don't know whether those particular models appear on our Web site or whether they are part of the OMB Web site.

Senator BOOZMAN. All right. The other thing, Mr. Ashe, I guess one of the problems I have also is that we hear a lot about forest fires, we hear a lot about beetles and things like that. The reality is, and I have heard many, many hearings and testimonies through the years, the reality is a lot of that stuff is poor management in the sense we had a hearing not too long ago and there was testimony to the fact that the areas that were privately managed out west where you had fire, some of the areas that are publicly managed are tinder boxes. The beetle infestation has been going on for a long time. And certainly climate has stuff to do with that.

But I do think that there is a tremendous, let's jump on this and this is all, the reality is, when you have a forest where you have, instead of 10 or 20 trees, whatever it can support, if you have 150 trees taking up the nourishment that makes it more susceptible to disease and things like that. Can you comment on that?

Mr. ASHE. Just quickly, I would say that certainly management can have a role to play and certainly can make a difference. But you have to realize that the public lands are managed for a much broader range of use. So if I have a private forest that is managed for short rotation and so I am just cycling those trees off and harvesting that timber on a regular basis, then mountain pine beetle is going to be less of a concern for you. Where in our public lands and like wildlife refuges in national forests where we are managing land for longer term, then pine bark beetle and other infestations can be more of an issue.

But I agree with you that management is part of this solution. We have to understand what that proper management is.

Senator BOOZMAN. Thank you, Madam Chair. I don't want to get gaveled on.

Senator BOXER. Well, you have 28 more seconds with which to continue.

Senator BOOZMAN. No, I will get some credit out of you and yield back my time.

Senator BOXER. Major credit, that is true.

So now we are going to complete this first panel, which started a very long time ago, it seems like yesterday. We are going to do it this way. I am going to give Senator Whitehouse, take my 2 minutes, Senator Vitter, then Senator Inhofe, Senator Sessions and then I will close. Everybody has 2 more minutes. So let's start with Senator Whitehouse.

Senator WHITEHOUSE. I will just take a little bit of my time to respond to Senator Sessions' suggestion that one scientist says that climate change isn't really happening and that there really isn't an association with storms. I just want to put that into context.

There actually is a peer-reviewed scientific consensus out there about this. It is massive. It is not unanimous, science is rarely unanimous. There are eccentrics, there are outliers, there are people who have non-mainstream opinions and to be blunt, there are people who are in concert with the polluting industries and delivering phony science, the way they did on tobacco, the way they did on a variety of other public health initiatives.

So when people pick out what one particular scientist said, it is important to look at that in the context of where the bulk of the science is. And if you don't believe science, then perhaps my friends from the other side will believe big corporations.

And one really big corporation that cares a lot about climate's effect on storms is Munich Reinsurance. Not only Munich Reinsurance, but the entire reinsurance industry and the property casualty insurance industry are virtually up in arms about what climate change is doing to their risk profile. Here is a graph that Munich Reinsurance puts together, showing the increase in natural catastrophes worldwide that are associated with climate change, A, in the sense that they are happening while climate change is happening, but B, and that we know some underlying science. We know, for instance, it is not disputed, that if you warm the ocean it creates more energy going up into storms and that makes stronger storms when they hit the shore.

So much of the science is was past debate. And if you simply take the science as way past debate and apply it, you draw the same conclusion. Are there eccentrics and outliers who can be quoted? Sure there are. But for this committee to rely on anything other than the massive consensus of peer-reviewed science, supported by not just environmentalists, but let's look at the people who are asking us to take action, Coke and Pepsi, Ford and GM, Nike, Wal-Mart, Apple, the Joint Chiefs of Staff, the U.S. Conference of Catholic Bishops, the Garden Clubs of America. At some point, people have to come to the realization that the scam that is being perpetrated has got to come to an end. And I hope that that time comes soon.

Senator BOXER. Thank you, Senator. Senator Vitter.

Senator VITTER. Thank you, Madam Chair. I just want to make a brief comment about science, too, and I think it is a useful transition to the next panel. I want to underscore Senator Wicker's and some others' comments. I think we do a real disservice to science and facts the way we often do a cartoonish gloss over these issues, which are often very complicated and subtle. It doesn't mean we don't need to figure it out, but we need to understand the real facts. And I would urge all of us to try to do that. Let me just use a couple of examples.

Senator Boxer said 97 percent of scientists, clearly, it is a clear consensus, 97 percent. Well, 97 percent is very catchy. But what is the underlying question? Human activity is causing increased CO_2 emissions. Well, I don't know why that is not 100 percent. I agree with that. I think everybody on this panel agrees with that. So let's mark it as 100 percent. That is not the issue we are debating.

Give you another example. Dan Ashe said in his testimony average surface temperatures are increasing. Interesting, that is not in your written testimony. Is that true since 1998?

Mr. ASHE. Senator, I think that average surface temperatures are increasing, as Senator Whitehouse said.

Senator VITTER. Is that since 1998?

Mr. ASHE. I don't know, I am no looking at the record since 1998. I am looking at the temperature record, the historical temperature record, average surface temperatures are increasing.

Senator VITTER. Over what period of time?

Mr. ASHE. Over a period of time that is relevant for natural resource management, which is looking at since the beginning of the industrial revolution.

Senator VITTER. My point is, we need to be precise and we don't need to game words. You also said sea ice and glaciers are melting. Did you mean net, and did you include Antarctica which is a continent, or is that not sea ice?

Mr. ASHE. Sea ice and glaciers are melting. It is indisputable, Senator Vitter, indisputable.

Senator VITTER. Are you saying net?

Mr. ASHE. I am saying sea ice and glaciers are melting, that is what I said, it is indisputable.

Senator VITTER. Well, they are always melting sometimes and elsewhere they are building. Are you claiming that that is net, and are you counting Antarctica, which is a continent?

Senator BOXER. We really need to move on.

Senator VITTER. If you could provide that for the record, because that is the level of detail and disciplined discussion that I think we need.

Senator BOXER. Senator Inhofe.

Senator INHOFE. Thank you. Let me try to get this out really quickly.

Ms. Sutley, several months ago the Corps of Engineers testified to Congress that it would not consider the life cycle of greenhouse gas emissions of coal exports when considering the environmental impact of a coal export facility licensed to the west coast. They said it would be outside the Corps' control and responsibility for the permit applications. Conversely, as you know, I believe, Columbia University's Center for Climate Change Law released a report in August saying that increased sales of coal in Asia are in effect the Corps' decision, meaning that they should be the scope of NEPA. Do you agree with Columbia or do you agree with the Corps?

Ms. SUTLEY. Thank you, Senator, for the question. We agree that agencies need to look at greenhouse gas emissions when they looking at their NEPA analysis.

Senator INHOFE. I am really sorry, but we are in 2 minutes, and I need to have that answer for the record. But I would like to ask you this to see if you would be in a position to let us know. Is there a date certain for finalizing the guidance for the including life cycle greenhouse gas emissions and the NEPA analysis?

Ms. SUTLEY. Senator, we continue to work based on the draft that we put out in 2010, we are working on revising that but I don't have a date certain yet.

Senator INHOFE. If you decide you are going to have one, would you try to let us know for the record?

Ms. SUTLEY. Yes, we will.

Senator INHOFE. We would appreciate that.

Let me just make this one comment. I know people get hysterical on all this stuff, but when Senator Whitehouse talked about the just one scientists, I have 700 scientists I listed in a speech on the Senate floor, probably 8 years ago, and these are scientists, Richard Lindzen from MIT, these are top scientists, totally refuting the assertion that is being made on which we are spending hundreds of billions of dollars. Just the bills that they try to do through legislation on cap and trade, that range, and no one disagrees with this, would be between $300 billion and $400 billion a year, and now through regulations it would be even more than that. So that cost is there.

In accordance with your predecessor, Lisa Jackson, when I asked the question, if we pass these things here, is it going to lower worldwide greenhouse gases, the answer was no, because this only affects the United States. This is not where the problem is, it is in China and India and Mexico, in other places. So I just want to say that we are talking about the largest tax increase in the history of this country if we were to go through with what they are trying to do through regulation that they could not do through legislation and not get anything for it. That is my question.

Senator BOXER. OK. Well, there is no question time. We have 2 minutes, you have gone over by a minute.

Senator Sessions. Two minutes.

Senator SESSIONS. Thank you, Madam Chairman. One of the things that we have heard today a good bit is carbon pollution. That is sort of a new phrase we are seeing a lot. You might wonder why that is happening. I think there is a great deal of unease in the pro-global warming community about what the Supreme Court is going to do. The Clean Air Act of 1970, I said earlier 1974, it was 1970, did not ban CO_2 and did not even consider the possibility of global warming, Ms. McCarthy.

So now the Supreme Court said you should make an endangerment finding and you have. And without any explicit, express authorization from the elected representatives of the American people, under this decision you have made, the Environmental

Protection Agency can go into any American's backyard, prohibit their barbecue grill, eliminate their lawnmower. You have that power. It is one of the greatest expansions of Federal power without explicit congressional authorization in the history of the Republic. You are able to go in any place where any carbon is produced and regulate that, because you say it is a pollutant. And the Supreme Court ruled five to four that you should make a formal finding on that. They have not ratified our decision. And with the altering of the predictions and the global warming projections that are not coming true, I would hope that they would not allow you to have that power, finally, when they finally rule on it.

So I want to say, Congress has never authorized such an action. They would never authorize it today. And you should be really careful about the assertion of power that you have.

I thank the Chair.

Senator BOXER. Thank you.

Just for the record, the D.C. Court recently upheld the ruling of the Supreme Court. So let's just stop relitigating something that went all the way to the Supreme Court.

Senator SESSIONS. It is going back to the Supreme Court.

Senator BOXER. I don't want to be interrupted, please. I didn't interrupt you.

Senator SESSIONS. You used the power of the Chair to dispute what I had said.

Senator BOXER. I did not.

Senator SESSIONS. I felt I had a chance to respond.

Senator BOXER. I will use freedom of speech to correct folks who I believe are wrong and I will defend your freedom of speech to do the same. Now, let's be clear. D.C. Court upheld this, period, and it is moving forward. And if you don't act, you are going to be sued. And the American people want this done.

I just looked at the polling. Only 3 percent of younger voters don't believe climate change is happening. You look at Republicans. The latest poll I saw said that a vast, well, well over 50 percent said that if you are a climate denier, you are out of touch. So I wish this committee would find the common ground with the American people. Because when you deny you are doing just what people said when they said cigarette smoking doesn't cause any harm.

A couple of other things, 1980 to 1990, hottest decade on record until 1990 to 2000, which became the hottest decade on record, until 2000 to 2010, which is now the hottest decade on record. That is not me. That is not EPA. That is NOAA. In 2008, the Bush administration used a form of the social cost of carbon on fuel economy rules. They used it on air conditioner rules, efficiency rules, and frankly, I never heard a peep out of anybody at that time.

Now, I don't know why my clock isn't moving, but it should be moving, it should be down to a minute.

Let me just close with this. We know what happens when the environment is thrown under the bus. It is called China. And I am going to put into the record today Airpocalypse, Smog Hits Beijing at Dangerous Levels. On Thursday residents of Beijing woke up with splitting headaches. Bottom line, 1.2 million Chinese died in 2012 because of air pollution.

Now, I will do everything in my power to make sure that this Clean Air Act, which passed in this very sacred room, so many years ago, in a bipartisan way, that that Clean Air Act is upheld and that everything we do is consistent with the law. And this one went all the way to the Supreme Court. And the fact of the matter is we have to make sure we uphold it.

Now, that is the end of this panel. What I want to make sure, because Senator Vitter is very anxious to have another hearing about Mr. Beale. And I am not.

[The referenced material follows:]

‘Airpocalypse’ Smog Hits Beijing at Dangerous Levels

By EDWARD WONG

JANUARY 16, 2014, 4:52 AM

On Thursday, some residents of Beijing woke up with splitting headaches. A curtain of haze had fallen across the city of more than 20 million. It was the first “airpocalypse” of the year in the Chinese capital and nearby provinces, and it had come appropriately enough one year after a similar event had led to widespread anxiety.

“How does the smog differ from the apocalypse?” Joe Wong, a comedian from northeast China, wrote on his microblog on Wednesday night, when the pollution levels had begun surging. “After the apocalypse, you no longer worry about the smog.”

On Wednesday night, the United States Embassy in Beijing began sending out online warnings that the air quality level had gone above 500, the upper limit of the measurement scale, and was now “beyond index” (or “crazy bad,” as one embassy employee had written on an official embassy Twitter account several years ago.) It stayed at that level until Thursday, when it dipped to “hazardous” from “beyond index.” Hazardous means an air quality index above 300, at which point the concentration of fine particulate matter in the air is many times the exposure limit recommended by the World Health Organization. American health officials say a hazardous rating means people should avoid venturing outdoors.

Xinhua, the state news agency, reported that Chinese officials had ordered the closing of some highways, and visibility in some parts of Beijing was expected to drop to 500 meters. The municipal government issued a yellow smog alert at 7 a.m. “The smog is forecast to last until Friday morning,” Xinhua reported.

The four major highways closed were those from Beijing to Shanghai, Daqing to Guangzhou, Beijing to Harbin and Beijing to Pinggu.

The relentless pollution in Chinese cities has had other economic effects. China Daily, an official English-language newspaper, reported on Mondaythat there was a severe drop in tourism in Beijing last year, in part because of pollution. From January to November in 2013, the city had 4.2 million visitors, down 10.3 percent from the same period in 2012, China Daily reported, citing statistics from the Beijing Tourism Development Commission.

The report said the commission blamed the pollution, the weak global economy and a strong renminbi.

Some researchers have concluded that air pollution shortens lifespans considerably. One recent study said outdoor air pollution in China contributed to 1.2

million premature deaths in 2010. Another study showed that residents in one part of northern China had lived five years less on the average than residents in southern China because of pollutants from extensive coal burning for winter central heating in the north.

Some well-known online commentators posted photographs on Thursday of the invisible Beijing skyline.

"This is what it looks like outside of my window, severe smog," wrote Ren Zhiqiang, a prominent real estate tycoon, while posting two photos that were little more than snapshots of gray.

One American graduate architecture student, Benjamin Golze, braved the smog to travel to the Beijing airport to catch a flight, though flights in northern China are often delayed because of smog. Mr. Golze had just spent two-and-a-half weeks in Beijing to study how to design an embassy building that can look beautiful while keeping out polluted air. The concept is for his master's thesis project at the University of California, Berkeley.

"People spend something like 80 percent of their lives indoors," he said in an interview. "At that level, you have to start thinking about the long-term effects of the chronic condition."

He added that in environments like those of Chinese cities, architects and mechanical engineers need to veer away from a traditional idea, especially popular among Western engineers, that indoor air is bad and outdoor air is good. Because of that notion, he said, many engineers spend time trying to figure out how to alleviate air pollution from indoor sources rather than deal with penetration of a building by outdoor pollutants.

"The idea is a result of the long tradition of glass buildings being totally sealed from the outside and toxic materials being used inside and the building not being vented properly," Mr. Golze said. "It takes a conceptual flip to figure out what to do here."

Patrick Zuo contributed research.

http://sinosphere.blogs.nytimes.com/2014/01/16/airpocalypse-smog-hits-beijing-at-dangerous-levels/

Senator VITTER. To have a hearing about Mr. Beale.

Senator BOXER. We had a briefing. He wants a hearing, in addition to the briefing, in which he asked 50 questions. It is his right to ask that. What I am going to ask you, Administrator McCarthy, since no one asked you about that, although it was in the scope of hearing, would you please answer the question and take a week to do it, what is in place now, we know that this con man is going to jail. But what is in place now at the EPA to make sure this never happens again? If you would get that to us, the Chairman and the Ranking, and members of the committee, in about 2 weeks, can you do that?

Ms. MCCARTHY. Yes, sure.

Senator BOXER. And then we will look at whether or not we need a hearing.

I want to thank the panel. It has been a tough morning for you. You handled all the questions, I think, with great integrity. Please now go back to your normal work and we will call up the second panel. And if the second panel can come up very quickly, because the caucuses have meetings shortly.

OK, if everyone could leave, we are going to get going right now. Thank you to the first panel. We are getting started.

And we are going to start with Hon. Bill Ritter. You had a wonderful introduction from your Senator, so please, sir, proceed. You are the Director of the Center for the New Energy Economy, Colorado State University.

STATEMENT OF HON. BILL RITTER, JR., DIRECTOR, CENTER FOR THE NEW ENERGY ECONOMY, COLORADO STATE UNIVERSITY

Mr. RITTER. Thank you, Madam Chairman. I appreciate the opportunity. Ranking Member Vitter, other members of the committee, I appreciate the opportunity to be here today and testify before the committee regarding the President's climate action plan, but particularly with the work that I do at Colorado State University that really involves what States are doing around the country regarding energy and particularly regarding clean energy.

I left office in 2011 and founded the Center at Colorado State University, so for the past 3 years I have worked with States on energy policy. We have developed actually a Web site that tracks every piece of advance energy legislation at the State level. There were 3,600 separate pieces of energy legislation introduced in State houses across America last year; 600 of those were signed into law by Governors across the country.

It is important in this discussion to understand that clean energy is on the minds of Governors across the country. There are 220 million Americans who live in a State that has a renewable energy standard or renewable energy goal. About 240 million Americans that live in a State with an energy efficiency resource standard, and a number of Americans similar to that number that live in a State with a climate action plan.

What is really important as well about that is those States include both States where there is Democratic leadership and Republican leadership. If you just look at sort of the recent past, what Republican Governors have done with respect to renewable energy standards or energy efficiency resource standards or just generally with the topic, you get a sense that this is a bipartisan sort of coalescing at the State level.

Governor Snyder in Michigan just recently announced a plan to increase the renewable energy standard in Michigan as well as mix with natural gas and try and lessen the amount of coal that there will be in Michigan. They import 100 percent of their coal; it is about 60 some percent of their fleet. Governor Kasich in Ohio has been very good about looking at natural gas regulation as a part of his work there. But as well, he has looked to the manufacturing association for Ohio and another group called the Advanced Energy Economy of Ohio with regard to sort of their input on the renewable energy standard and the energy efficiency resource standard.

There was a real concerted effort in the United States across the States last year to undo the renewable energy standards in different States and the energy efficiency resource standards, including in Ohio. Every one of those efforts actually wound up failing and every one of the States, including those that are under Republican leadership, were able to beat back those efforts. So Governor Sandoval, actually the Republican Governor in Nevada, expanded the renewable energy standard. Governor Brewer in Arizona often champions solar as an important part of that State's growing economy. Governor Brownback in Kansas was another, this is another State where they did not, they were not able to attack or defeat the renewable energy standard. And it was beaten back and really, with the support of Governor Brownback with the support of the wind industry there.

Our experience in Colorado is interesting to think about. As Senator Udall said, we expanded our renewable energy standard to 30 percent over the, by 2020, we did it with a rate cap in place to protect consumers. But that has created jobs in a significant way, and as well, it is interesting to think about Xcel Energy, the major investor-owned utility in Colorado, because of the efforts to combine both the transition of coal to natural gas as well as a 30 percent renewable energy standard, Xcel will reduce their emissions. This is a major investor-owned utility, reduce their emissions from 2005 to 2020 levels by 35 percent.

It is important to understand that this is all done in conjunction with the Federal Government, and why the President's Federal climate action plan is so important. Because it is not just States acting alone, it is actually a great deal to do with a variety of things, including EPA rulemaking where SIPs were required. The Department of Energy, working in concert either with technical assistance or with research assistance for States, developing their State energy plans, and certainly as utilities, look at the future and understand that a different business model is probably going to be required over the next 10 or 20 or 30 years to have the Federal Government's assistance, both from the Department of Energy perspective as well as other agencies, and trying to help this very important industry understand how to shift its rate design, its revenue model.

So those are all part of what the Federal Government can do in interacting with States. States are a vital part of this Nation's climate action plan. States have shown great success in actually being able to hold rates at a fairly steady rate. In Colorado, for instance, below the consumer price index increases, below inflation. Even with an aggressive renewable energy standard like 30 percent. And at the same time, show job creation as a result of it.

So I come here, Madam Chairman, appreciative of the time that I have to speak about this and willing to answer any questions. Thank you.

[The prepared statement of Mr. Ritter follows:]

Testimony of Bill Ritter, Jr, 41st Governor of Colorado
U.S. Senate Committee on Environment and Public Works

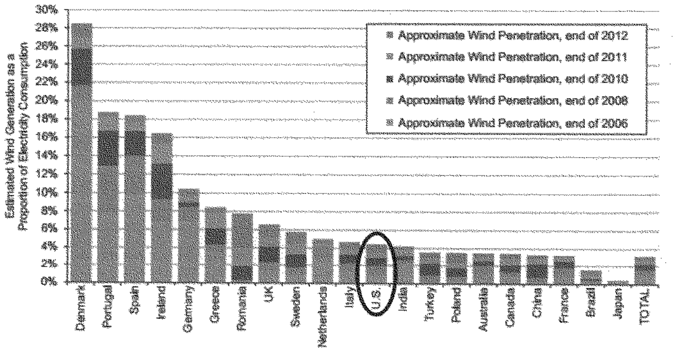
January 16th, 2014

Chairman Boxer, Ranking Member Vitter and members of the Committee:

Thank you for the opportunity to speak to you today and to offer my perspective on how states are leading the U.S. in implementing clean energy. The Center for the New Energy Economy, which I founded in 2011, works directly with governors, legislators, regulators, and other decision makers. We provide technical assistance to help states create the policies and practices to facilitate America's transition to a clean-energy economy. Through this work, we have developed an insight into trends in state advanced energy policy which I would like to share with you today.

States lead, but the U.S. lags

When viewed from an international context, the U.S. is seen as lagging the rest of the developed world in a committed approach to deploying clean energy technologies. The chart from Lawrence Berkeley National Laboratory shows year end 2012 percentages of energy generation from wind energy for developed countries.



Source: Berkeley Lab estimates based on data from Navigant, EIA, and elsewhere

Despite the fact that climate is a global issue, states are leading the U.S. forward. Today, 220 million Americans live in a state with a Renewable Portfolio Standard (RPS) and 240 million live in states with a plan to reduce greenhouse gas emissions[1,2]. When taken in

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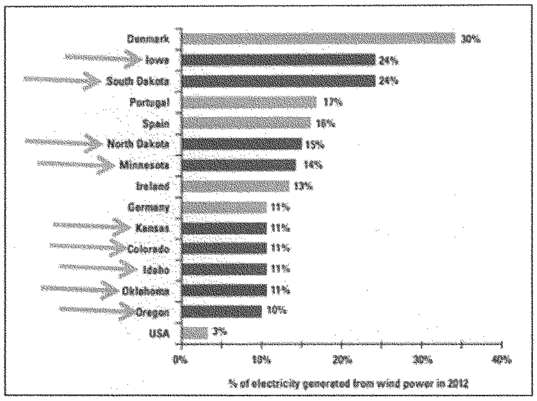
[1] Twenty nine states, Washington D.C. and two territories have Renewable Portfolio Standards. Database of State Incentives for Renewables and Efficiency.

aggregate, the population of states that have an RPS is equal to the fifth largest country in the world. For those states with commitments to reduce greenhouse gas emissions, the combined population would be the fourth largest country in the world. As a percentage of electricity generated, for example, U.S. States assume leadership internationally for wind generation (see right).



The American people and their state leaders recognize and acknowledge the wisdom in reducing pollution for myriad reasons including economic opportunity, public health, and reduced risk for the consumer as well as the critical issue of addressing global climate change.

The state perspective

In 2013 alone, there were over 3,200 advanced energy bills introduced across the country – a volume of legislation that illustrates how important clean energy is to state policymakers. Of the 3,200 introduced bills, nearly 600 were signed into law by the nation's Governors. My Center built and maintains a state legislative database called the Advanced Energy Legislation Tracker, which catalogues and tracks all advanced energy legislation introduced around the country[3].

One of the noteworthy legislative trends in 2013 was the degree to which states defended their RPS policies[4]. There were more than 120 RPS-related bills introduced around the country this session. Of those, 26 bills were attempts to dismantle or altogether eliminate RPS policies. None of these 26 legislative proposals were successful[5]. In fact, the end result of the 2013 session was that Colorado, Minnesota, Nevada and Maryland each increased

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[2] Twenty five states have Energy Efficiency Resource Standards. American Council for and Energy-Efficient Economy.

[3] Advanced Energy Legislation Tracker. Center for the New Energy Economy. www.aeltracker.org

[4] Center for the New Energy Economy. State Renewable Portfolio Standards Hold Steady or Expand in 2013 Session.

[5] The following states defended their RPS policies against rollback attempts in the 2013 session: California, Colorado, Connecticut, Hawaii, Kansas, Maryland, Minnesota, Missouri, Montana, North Carolina, Ohio, Oregon, Pennsylvania, Texas, Washington, West Virginia, Wisconsin.

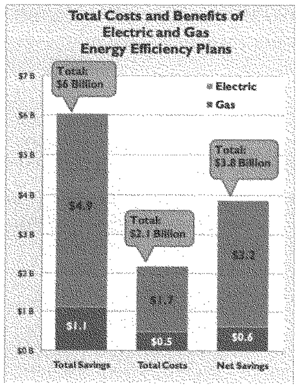
existing RPS policies. The fact that 26 attempts to rollback standards all failed this past year speaks to the benefits that these policies have brought to local and state economies. The bottom line is that the market for clean energy is larger than it was a year ago.

State Policy Highlights

In several states around the country, notable policy efforts are underway. In each of these instances, Governors and Legislatures are exercising impressive leadership in addressing the changing dynamics of the energy world. Here are a few examples:

New York – In September, Governor Cuomo announced the creation of a $1Bn fund to finance clean energy projects. While this fund represents the largest state finance effort, Governor Cuomo followed it up with an equally impressive commitment of $1Bn toward the NY Sun initiative. This program not only provides a streamlined process for consumers to install solar energy and seamlessly finance projects, it also streamlines the permitting and approval process for solar installations, greatly reducing costs for solar companies and, similarly, for their customers.

These programs promise to vault New York into a leadership position in solar energy installations.



Massachusetts –Governor Patrick's administration has been a shining star on energy issues, fundamentally transforming Massachusetts into a national leader during his administration. Beginning with the landmark Green Communities Act of 2008, renewable energy installations have skyrocketed along with high performance building standards and most notably, a complete transformation of energy efficiency programs in the state. As the figure to the left demonstrates, the state's leading suite of energy efficiency policies has saved Massachusetts citizens nearly $4 Billion dollars and earned the state a number one ranking three years in a row from The American Council for and Energy Efficient Economy (ACEEE).

At the end of December, Governor Patrick announced a ground breaking grid modernization commitment for Massachusetts. All utilities will need to submit a grid modernization plan within six months and the Department of Public Utilities will begin to evaluate new utility business models that will align the state's public policy objectives with the utility's earnings on investment while planning for a greatly expanded electric vehicle infrastructure.

Nevada – In 2013, Governor Sandoval signed legislation to shut down the 800 MW Reid-Gardner coal plant, ending the state's commitment to burning coal for electricity. The landmark legislation replaces the generation with a combination of renewable energy, natural gas and energy efficiency signaling a shift toward cleaner air, water and a strengthened economy for the state.

Arizona – The Arizona Corporation Commission (ACC) demonstrated a thoughtful approach to utility concerns with the state's growing and thriving solar. The utility claimed it was losing revenues from net metering (crediting of customers for power they feed into the grid from a solar installation on their home or business) in the state that were critical to paying for the utility's infrastructure. Arizona Public Service proposed a monthly fee of $75 on every solar customer to cover these infrastructure costs. The ACC recognized the need to quantify these costs and attribute them to the solar customers, but also were sensitive to the economic impact of crippling the growing solar industry in the state. As a compromise, the ACC proposed a 70¢/kW/month charge on solar customers ending a contentious and divisive debate over the future of solar in the state.

Ohio – Governor Kasich lead a successful revision to the state's oil and gas regulatory structure in 2012 putting in place a set of regulatory reforms in the state statutes that represent a responsible regulatory structure that will both allow the industry to thrive and grow while protecting the environment for future generations. In 2013, the legislature rejected efforts to undermine the state's energy efficiency and renewable energy requirements crediting the standards with saving consumers $300M each year. Two industry groups: Advanced Energy Economy Ohio and the Ohio Manufacturers Association lead the charge in opposition to undermining the state's efficiency standard raising concerns of the impact on consumers and the economy.

The Colorado Story

Colorado represents a state that has truly taken an "all of the above" strategy with an eye toward substantially reducing pollution while expanding economic opportunity in the state. Colorado is a natural gas producing state and we see natural gas as a critical component to reducing greenhouse gas pollution within the electric generation sector. We also see a critical role for both energy efficiency and renewable energy as a part of that effort.

As Governor, I signed 57 clean energy bills into law[6], including the following policies:

1. Reformed the Colorado Oil and Gas Commission to remove a statutory requirement that the industry have a majority of seats on the commission, expand the representation and put in place important regulatory measures to ensure best practices in siting and drilling for natural gas.

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[6] A list of all clean energy bills signed into law by Governor Ritter http://cnee.colostate.edu/p/new-energy-legislation

2. Passed an EERS that makes energy efficiency the best financial investment a utility can make, sets goals for demand reductions and allows for bonuses for exceeding those goals.

3. Doubled the voter approved 10% RPS to 20% in 2007 and then tripled it to 30% in 2010. We did this while maintaining the critical price protections for consumers of no more than a 2% impact on rates.

4. Passed the "Clean Air, Clean Jobs Act" in 2010 which replaced nearly one gigawatt of Front Range coal generation with natural gas, efficiency and renewables while protecting ratepayers and decreasing harmful emissions of EPA Criteria Pollutants.

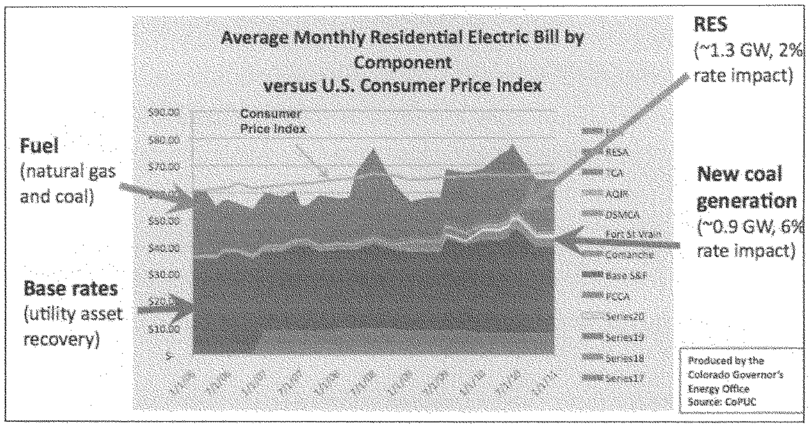
In 2007, I issued a Climate Action Plan through executive order that set a goal to reduce statewide greenhouse gas emissions to 20% below 2005 levels by 2020. We asked utilities to achieve these reductions within their generation fleets. At the time, this was perceived by some as a long stretch. Public Service Company of Colorado (PSCO - the Colorado subsidiary of Xcel Energy) recently announced that, due primarily to the policies noted above, they project a reduction in emissions by 2020 of 35% below 2005 levels from their Colorado fleet – greatly exceeding our climate action goal.

In their 2011 Electric Resource Plan, PSCO Energy stated: *"we have proposed to acquire an additional 200 MW of wind from the Limon II facility to capture the energy savings benefits from that facility"* – this request to the Colorado Public Utilities Commission was not made because of any RPS requirement, but rather on the grounds of economic and resource benefits.

Again in October of last year, Xcel Energy proposed to the PUC to procure 170 MW of solar and 450 MW of wind power strictly on economics, not for compliance with the RPS. The CEO of Public Service Company of Colorado, David Eves, told the Denver Business Journal "This is the first time that we've seen, purely on a price basis, that the solar projects made the cut – without considering carbon costs or the need to comply with a renewable energy standard – strictly on an economic basis."

Perhaps most importantly, Colorado has been able to accomplish this all of this without raising rates for consumers. Looking at consumer bills from 2006 to 2011 (chart below), consumer rates did not increase relative to the Consumer Price Index. This chart also illustrates the exposure to fluctuations in coal and natural gas contracts in consumer rates which represents financial risk to the Colorado ratepayer.

Colorado electricity rates were 19% below the national average when I took office and 21% below the national average when I left office. During that same time, the installed renewable energy capacity increased from 200MW to nearly 2,000 MW and is now going to more than 2,700 MW.



Produced by the Colorado Governor's Energy Office
Source: CoPUC

The job creation benefits of these policies are significant. In addition to the thousands of jobs created in the energy efficiency, renewable and natural gas sectors from these policies, we were able to attract one of the world's leading wind turbine manufacturers, Vestas, to locate their North American manufacturing headquarters to Colorado. Today, if a Vestas turbine is being installed anywhere in America, the blades, nacelles and towers are manufactured in Colorado, employing thousands of Colorado workers.

As policy makers, we do our best with the information available to create sound public policy. One can never be certain whether those policies achieved their objective until time bears out the results. The Colorado experience points to a tremendous success from both an economic and environmental perspective over just an eight-year period.
Stories like these are being developed in states across the country, ensuring that the U.S. will continue its foothold in the global clean energy economy. The Federal Government can assist states in scaling policies and advancing technologies and give the U.S. a more enviable presence in the global energy market place.

Future state policy opportunities

In 2014, I see three major policy opportunities for states to continue to lead the country in deploying clean energy.

Implementing the Clean Air Act, Section 111(d)

Section 111(d) of the Clean Air Act requires states to develop plans for *existing* sources of non-criteria pollutants for EPA approval (i.e., a pollutant for which there is no national ambient air quality standard, such as CO_2).[7] These are referred to as "111(d) plans" and are similar to State Implementations Plans (SIPs) for criteria pollutants. Arguably one of the biggest near term opportunities for states to realize clean energy policy goals is to find a pathway for those policies in 111(d) plans submitted to EPA.

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[7] EPA, Region 7, Section 111(d) Plans.

In practice, this would include establishing the right boundaries for compliance. Current thinking in the literature offers three possible compliance paths for states under the pending EPA rule. Those options are: 1) a performance based standard by plant with no flexibility on boundaries, or commonly referred to as "inside the fence line" compliance; 2) a performance based standard with flexibility on boundaries, or commonly referred to as an "outside the fence line" compliance approach[8]; and 3) a state-wide budget approach in which each state manages reductions among utilities within the state geographic boundary.[9]

It is my belief that, "outside the fence line" will enable the greatest innovation and the greatest potential for new clean energy markets. Furthermore, this compliance path could set the stage for states to adopt Integrated Resource Planning in managing clean and conventional resources together rather than in separate resource portfolios as they are managed today.

Which clean technologies will see an incremental market as part of 111(d) planning? What legislative changes should states be considering in the 2014 legislative session to allow them to consider the broadest options? To the extent that states may need to pass new legislation for compliance with the 111(d) rules, waiting until the 2015 session may impose too much risk if not enacted given that the final plans will be due to EPA in June of 2016. EPA is expecting to issue a draft rule next June, which is well into and past most state legislative sessions in 2014.

States would be well served to begin planning now, performing the necessary resource and portfolio analysis which will be necessary for taking the most appropriate action in compliance with Section 111(d).

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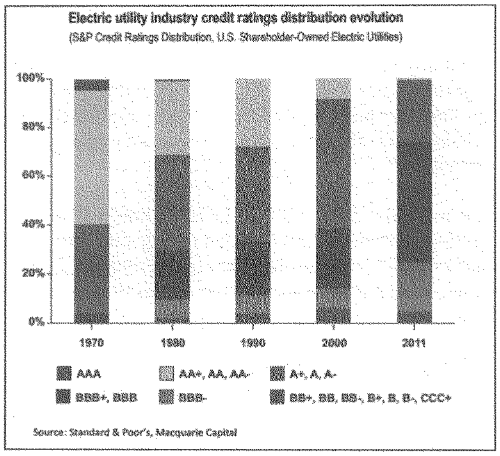
[8] It may be the case that "outside the fence line" compliance includes emissions reductions within a utility fleet of plants in order to achieve compliance rather than just the out of compliance plants. This option may include both emissions controls within a fleet to bring the average down and/or include non-central plant options such as EE, RE, DR, EVs, etc.

[9] M.J. Bradley & Associates. Structuring Power Plant Emissions Standards Under Section 111(d) of the Clean Air Act -- Standards for Existing Plants.

21st Century Utility Business Models

Utilities recognize the challenge before them and the increasing role of technology. At the heart of this challenge is the current application of a 20th Century regulatory model for a 21st Century economy.

Traditional, volume-based rate setting as a means of recovering embedded costs of depreciated assets is still common. When volume-based regulation was put in place, however, large-scale generation made sense and utility load was growing. Today, load is declining, productivity is increasing, consumers are asking for new products and services, and we are experiencing a growing trend toward distributed power sources.


Electric utility industry credit ratings distribution evolution
(S&P Credit Ratings Distribution, U.S. Shareholder-Owned Electric Utilities)

Source: Standard & Poor's, Macquarie Capital

Put another way, public objectives are not in line with the current utility revenue model. As a result, utilities have seen their credit ratings slip considerably over the last four decades (above).

Ultimately, we will need a 21st century utility revenue model that aligns with the expectations, desires and capabilities of a 21st century market. States are just beginning to move in this direction, most recently with great leadership from the Commonwealth of Massachusetts. This will become an increasingly pressing issue for states, utilities and utility regulators.

Access to Financing

In late 2011, investment in the clean tech sector surpassed $1 trillion dollars making clear the industry has taken root in the global economy.[10] Yet a tremendous amount of investment capital still remains on the sidelines waiting for consistent public policies that support clean energy. The current patchwork of state energy policy, financing programs, and regulatory structures combine for a complex market for institutional investors seeking opportunities. The underlying fabric that allows for scalable investment in the renewable energy sector is heavily dependent on access to reliable capital.

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[10] Bloomberg New Energy Finance. Global Trends in Renewable Energy Investment in 2011.

In order to take full advantage of America's full renewable energy potential, we must usher in a new era of collaboration between state energy policy makers, the finance community and program implementers. In the 2013 legislative session alone, there were over 650 bills introduced to enable financing (including tax credits) for advanced energy of which nearly 100 became law. States are trying to unlock financing for clean energy.
For large scale investments for renewable generation, large capital markets such as Real Estate Investment Trusts (REITs) and Master Limited Partnerships (MLPs) are closed to renewable energy. As a result, renewable developers rely on tax equity markets which are much more limited in scope and scale. Access to these capital markets could further drive down the costs of renewable energy onto the grid.

For the large distributed market for renewable and efficiency retrofits, the Federal government can play an important role in providing credit enhancements through subordinated debt or loan loss reserves. Furthermore, the investment pool needs standardization of program design. By reducing credit risk for private capital and serving as a facilitator of consistent program design to attract private capital, costs can be reduced for citizens and businesses throughout the nation.

Closing Remarks

States continue to lead in the pursuit of a new energy economy for the nation – and in many ways that makes sense within our federalist system of government. But there are important roles for the Federal Government to ensure American leadership in the burgeoning global new energy economy.

A recent report from Pike Research estimated this global market at $1.2 trillion dollars in 2011 and growing at a terrific pace. We can be leaders in developing, implementing and marketing advanced energy technology to the world or we can buy the technology from others. In many ways, this is the choice before you.

I urge you to choose leadership.

Biography

Bill Ritter, Jr. is director of the Center for the New Energy Economy (CNEE) at Colorado State University. The Center launched on February 1, 2011, with Ritter as the founding director. The Center employs an assistant director, three senior policy advisors, an executive assistant and a part-time student research team.

The Center works directly with governors, legislators, regulators, planners, policymakers, and other decision makers. It provides technical assistance to help officials create the policies and practices to facilitate America's transition to a clean-energy economy.

Ritter is a member of the board of the directors of the Energy Foundation and a senior fellow and member of the board of directors of the Advanced Energy Economy Institute.

Ritter was elected as Colorado's 41st governor in 2006, and built consensus to tackle some of our state's biggest challenges. During his four-year term, Ritter established Colorado as a national and international leader in clean energy, by building a new energy economy. As a result of that work, Colorado created thousands of new jobs and established hundreds of new companies. Ritter enacted an aggressive business-development and job-creation agenda, focused on knowledge-based industries of the future: energy, aerospace, biosciences, information technology, and tourism.

Ritter earned his bachelor's degree in political science from Colorado State University (1978) and his law degree from the University of Colorado (1981). With his wife Jeannie, he operated a food distribution and nutrition center in Zambia. He then served as Denver's district attorney from 1993 to January 2005.

The Ritters have four children: August, Abe, Sam, and Tally.

Responses from Governor Bill Ritter, Jr to questions from Senator Barbara Boxer and Senator Jeff Sessions following testimony Environment and Public Works Committee Hearing titled "Review of the President's Climate Action Plan", January, 16, 2014.

Questions from Senator Barbara Boxer

1. ***Your testimony describes a wide range of actions states are taking to address climate change and promote clean energy. Can you describe how the President's Climate Action Plan will lead state governments to do more to address climate change?***

One of the most significant and immediate actions that states are taking in response to the President's Climate Action Plan is preparing for compliance with Section 111(d) of the Clean Air Act. As the Climate Action Plan notes *"Power plants are the largest concentrated source of emissions in the United States, together accounting for roughly one-third of all domestic greenhouse gas emissions."*[1]

President Obama directed the Environmental Protection Agency (EPA) through Presidential Memorandum to develop emissions standards for both new and existing power plants. While the new power plan rules under Section 111(b) have been issued, the even more critical draft rule for existing plans under Section 111(d) is expected to be issued in June of this year by EPA. State leaders, utilities, planners, air quality regulators and policy makers around the country are actively engaged in conversations about innovative approaches to meet the new emissions requirements. The discussions include expansion of existing regional carbon trading programs; deployment of clean energy technologies such as energy efficiency, demand response and distributed generation that are "outside the fence line" of central power plants; and fuel switching from coal to natural gas fired generation.

In many ways, this single section of the President's Climate Action plan has catalyzed a new phase of policy innovation in the utility industry.

2. ***What are some of the critical executive actions the President can take to reduce carbon pollution and promote clean energy?***

The Center for the New Energy Economy, which I direct, recently released a report titled Powering Forward: Presidential and Executive Agency Actions to Drive Clean Energy in America which outlines over 200 presidential and executive agency actions for the

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[1] The President's Climate Action Plan, June 2013.
http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf

Administration to consider. These are steps that can be taken without action from Congress to advance clean energy and reduce carbon pollution in five segments of our energy sector: energy efficiency, renewable energy financing, responsible natural gas production, 21st century utility business models, and alternative fuels and vehicles[2].

What makes this report unusual is the breadth and depth of the recommendations, the fact that it was inspired by a meeting convened by the President, and the involvement of more than 100 industry C-level executives, non-government organizations, and state officials from across the country. Here are a few of the recommendations in the *Powering Forward* report:

- **Leverage the federal government's buying power:** We recommended that the President issue even more aggressive goals for the use of Energy Savings Performance Contracts (ESPCs) by federal agencies to obtain guaranteed savings at no cost to taxpayers. We suggested that ESPCs be applied beyond buildings to other areas of potential energy savings.

- **Unleash private capital:** One of the more significant actions the White House could take to spur more capital investment involves the government's several residential and commercial energy efficient mortgage programs. We found that research over the past 20 years consistently showed that energy efficiency improvements in a home reduce the chance that its owners would default or become delinquent on their mortgages. We recommended that the Administration substantially increase consumer awareness of these programs and their benefits.

- **Modernize our utility regulatory polices:** Utility executives told CNEE during the development of this report that they see the benefits to their customers from incorporating new technologies such as solar and wind power into their systems, but state and federal utility regulations are not keeping pace. We recommended that the Administration identify and update regulations that have become barriers to the significant changes utilities must make to keep up. We also suggested that some of the federal government's own power assets could become proving grounds for the new policies utilities need to adopt to accommodate more clean energy technologies.

- **Create long-term market certainty with policies informed by full carbon life-cycle analysis and full cost accounting.** At present, the federal government lacks the tools to do a full life-cycle analysis of our energy choices – analyses that count societal costs and benefits as well as environmental and economic factors. EPA's methodology on the social cost of carbon is a start and agencies do use life-cycle accounting, but they define it differently and it doesn't yet include all quantifiable benefits and costs. As we know, many of the energy prices in the marketplace don't accurately reflect their true costs, from national security to public health. A state of the art method of assessing full costs and benefits would allow policy makers to see clearly which of our energy options provide the greatest benefit to the country at the lowest cost.

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[2] *Powering Forward: Presidential and Executive Agency Actions to Drive Clean Energy in America.* Center for the New Energy Economy at Colorado State University. January, 2014. www.poweringforwardplan.org

3. ***Your testimony describes a wide range of actions states are taking to address climate change and promote clean energy. Do many of these state actions have bi-partisan support?***

Today, approximately 200 million Americans live in states with Renewable Portfolio Standards (RPS) and roughly 220 million live in states with plans to reduce greenhouse gas emissions[3].

CNEE maintains an Advanced Energy Legislation Tracker, which enables us to analyze trends in state advanced energy policies. For example, we have tracked the degree to which state legislatures defended their RPS mandates. In 2013 alone, there were 26 individual bills to roll back or dismantle existing portfolio standards. These 26 bills were introduced in California, Colorado, Connecticut, Hawaii, Kansas, Maryland, Minnesota, Missouri, Montana, North Carolina, Ohio, Oregon, Pennsylvania, Texas, Washington, West Virginia and Wisconsin. All of them failed. In fact, three states expanded their RPS in the 2013 session – Nevada, Colorado and Minnesota.[4]

State legislatures understand the economic and environmental benefits that accrue to their state from these policies and have universally acted to keep them in tact or expand them.

Regional polling data also show strong bi-partisan support for renewable energy in the Rocky Mountain West. The annual Colorado College bi-partisan Conservation in the West poll found in 2011 that 65% of voters in Colorado, Montana, New Mexico, Wyoming, and Utah "would dramatically increase the amount of their state's electricity needs produced by renewable sources".[5]

National public opinion polls also find strong bi-partisan support for clean energy. A Yale Project on Climate Change and Communication survey found that *"A large majority of Americans (87%, down 5 percentage points since Fall 2012) say the president and the Congress should make developing sources of clean energy a "very high" (26%), "high" (32%),*

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[3] Twenty nine states and Washington D.C. have RPS policies, eight states have RPS goals. Database of State Incentives for Renewables and Efficiency.
http://www.dsireusa.org/documents/summarymaps/RPS_map.pdf

[4] *State Renewable Portfolio Standards Hold Steady or Expand in the 2013 Session.* Center for the New Energy Economy. July, 2013. http://www.aeltracker.org/graphics/uploads/2013-State-By-State-RPS-Analysis.pdf

[5] State of the Rockies Project – Conservation in the West Poll. Colorado College, 2011-2014.
http://www.coloradocollege.edu/other/stateoftherockies/conservationinthewest/

or medium priority (28%). Few say it should be a low priority (12%)."[6]

4. ***Will the state actions you describe and the actions put forth in President Obama's Climate Actin Plan create jobs, enhance the country's leadership in clean energy, and benefit the U.S. economy?***

Absolutely. My experience promoting a New Energy Economy as governor of Colorado is that we were able to create thousands of new jobs, attract new businesses and deploy well over two gigawatts of renewable energy without increasing costs for consumers[7].

Specific to the President's Climate Action Plan, the World Resources Institute estimates that actions by utilities to reduce existing power plant CO_2 emissions as a result of the pending EPA rule would cost ~$4 billion/year by 2020 but would avoid $25-$60 billion/per year in health care and climate change costs[8].

The Climate Action Plan also reaffirms the administration's focus on increasing appliance energy and water efficiency standards. The American Council for and Energy Efficient Economy (ACEEE) and the Appliance Standards Awareness Project (ASAP) find that consumers could save $26 billion by 2025 with 34 new or updated energy efficiency standards, several of which are already under review or approved.[9]

The Alliance to Save Energy estimates that another of the President's goals – doubling America's energy productivity by 2035 – will save $327 billion in 2030, including $97 billion in energy costs for buildings, $139 billion in transportation and $94 billion in industry. These savings can be invested much more productively in business expansion and jobs, for example. The Alliance estimates that if this goal is achieved, it will add 1.3 million jobs, cut the average household's energy costs by $1,000 each year and increase GDP by as much as 2%. These findings are the product of a bipartisan commission formed by the Alliance[10].

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[6] Yale Project on Climate Change Communication. April, 2013. http://environment.yale.edu/climate-communication/article/Climate-Policy-Support-April-2013

[7] A Blueprint for a New Energy Economy. http://www.cnee.colostate.edu/graphics/uploads/BluePrintfortheNewEnergyEconomyColorado.pdf

[8] World Resources Institute. *By the Numbers: The Economic Benefits of a National Climate Action Plan.* June, 2013. http://www.wri.org/blog/numbers-economic-benefits-national-climate-action-plan

[9] ACEEE. *The Efficiency Boom: Cashing in on the Savings from Appliance Standards.* March, 2012. http://www.aceee.org/research-report/a123
http://www.appliance-standards.org/

[10] Alliance to Save Energy. Energy 2030. http://www.ase.org/policy/energy2030

Questions from Senator Jeff Sessions

1. Do I believe President Obama was correct in saying the temperature around the globe is increasing?

I believe the President is being advised by some of the best scientists in the world. In answering this question, however, I would like to make what I consider an important observation for policy makers at all levels of government.

I am not a scientist and I do not consider it worthwhile to debate climate science with other non-scientists. The debate within the science community, as lopsided as it is, is a very important part of the scientific process. However, the ongoing arguments between those in the lay community are too often exercises in which both sides select the studies that support their predetermined conclusions. I see little value in that.

As governor of Colorado, I believed, and I still believe that for policy makers, climate change is a risk management issue. If there is a realistic science-based possibility that climate change is underway and that its consequences will be as severe as many scientists predict, then I believe that public officials should help society manage the risks. In fact, it is our public duty.

The American people may or may not understand climate science, but they certainly understand risk management. We do it every day. Most of us don't expect to get into a serious automobile accident, but we take out insurance to mitigate the risk that it might happen. The same is true when we insure ourselves against our homes catching fire, or against catastrophic medical emergencies. We manage risk every time we buckle our seat belts or obey the speed limit. It is part of life.

But what if 97% of the world's climate scientists have got it wrong? What if we engage diligently in risk management only to find that the climate impacts we anticipated never happen? As so many people have pointed out, nearly all of the steps we need to manage climate risk – whether it is better energy efficiency or cleaner energy resources or opportunities for people to bike to work – are beneficial to our economy, our society, our health and the environment, no matter what the future brings.

So, with all due respect to elected officials and policy makers on both sides of the climate debate, I believe our time is much better spent managing the risks than continuing to argue about the science.

2. Does extreme weather justify the President climate action plan?

Again, I believe responsible risk management not only justifies but also requires steps like those in the President's Climate Action Plan, and more. It also justifies action by Congress and by the nation at large.

3. History suggests that a major energy transition takes 50-60 years. How long should we expect it to take for the transition to a clean energy economy?

Senator Sessions is correct about the historical record for major energy transitions. However, the historical record is not an accurate indicator of how long a clean energy transition will take or should take today. This is true in part because few if any energy transitions in the past have been driven by forces as powerful, pervasive and consequential as climate change; or by the population growth we see today; or by our unprecedented pace of technology development; or by what some have rightly called the greatest market opportunity in history. We've seen in the telecommunications industry how rapidly new technologies and consumer demand transformed that sector. History may have suggested that it would take 50-60 years to transition from the communications systems we had 15 years ago to the products and services we enjoy today. The same rate of transition is possible in the energy sector.

I believe a transition in the 2030 to 2050 timeframe is achievable. The National Renewable Energy Laboratory led a study in 2012 with a coalition of laboratories and expert organizations. They concluded that the U.S. could meet 80% of our electricity demand, each hour of the day in every region of the country, from renewable resources by 2050, if we modernize the electric grid and adopt enabling policies to realize this potential[11].

And that is the key question. It is not "Can we get there?" but rather "Can we work together to get there?" We have the technologies we need; we don't have to hold our breath waiting for technical breakthroughs. What's holding us up is our political will. So long as our political leaders refuse to take other key policy steps to move the transition forward as seamlessly and rapidly as possible, getting there will take far longer than it should. A carbon price is just one of the market forces that Congress could set in motion to move us forward. It is one of many ways to make our energy market work better. There may be other policy mechanisms that Congress could enact that have a similar impact as pricing carbon. The risk here is that Congress will do nothing and instead allow partisanship, gridlock, entrenched special interests or procrastination to hold us back from building a clean, efficient and internationally competitive 21st century economy.

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[11] NREL Renewable Electricity Futures Study. http://www.nrel.gov/analysis/re_futures/

Senator BOXER. Thank you.

I am going to hand the gavel over to my wing man here, Senator Whitehouse, due to other obligations, and he will complete the hearing. We are going to now hear from our next panelist, Dr. Andrew Dessler, Professor of Atmospheric Sciences, Texas A&M.

STATEMENT OF ANDREW E. DESSLER, Ph.D., PROFESSOR OF ATMOSPHERIC SCIENCES, TEXAS A&M UNIVERSITY

Mr. DESSLER. Thank you. My name is Andrew Dessler, I am a professor of Atmospheric Sciences at Texas A&M.

In my testimony, I will review what I think are the most important conclusions the scientific community has reached in over two centuries of work on climate. First, the climate is warming. By this I mean that we are presently in the midst of an overall increase in the temperature of the lower atmosphere and oceans spanning many decades. Second, most of the recent warming is extremely likely due to the emissions of carbon dioxide and other greenhouse gases by human activities. This is based on several lines of evidence, including observation of increasing greenhouse gases in our atmosphere and understanding of the greenhouse effect and a demonstration of the enhanced greenhouse gas effect can explain the observed warming.

For simplicity, in the remainder of my testimony I am going to refer to this mainstream theory of climate influence as the standard model. The standard model in fact can explain just about everything we observe in the climate system, both present day and during the geologic record. It has also made many successful predictions which are the gold standard of science. If you can successfully predict phenomena that are later observed, one can be supremely confident that a theory captures something essential about the real world. So as an example, climate scientists predicted in the 1960s that the stratosphere would cool while the troposphere would warm, as a result of increased greenhouse gases. And this was observed 20 years later. In the 1970s, climate models predicted the Arctic would warm faster than the Antarctic. This has also been subsequently confirmed.

The water vapor feedback is another fundamental prediction of the standard model that has just recently been observed. This explains why the bulk of the scientific community is so confident in the standard model. It explains just about everything, and it makes many successful predictions.

Now, you don't hear about this very often. Because scientists don't like to talk about things we know. I am uninterested in things we know; I like things we don't know. That is research. That is things where we can get stuff done.

And it is also true that obviously, this doesn't mean our knowledge is perfect. And this is reflected in uncertainty estimates that are provided in the consensus reports.

Now, a caveat. I said above the standard model explains virtually everything, which means there are a small number of observations that aren't necessarily well explained by the standard model, just as there are a few heavy smokers who don't get lung cancer. An excellent example of this is the so-called hiatus which has been mentioned several times. Slow warming of the surface temperature over the last decade or so. This is frequently presented as an existential threat to the standard model. But as I describe below, this greatly exaggerates its implications.

Before I explain why, I think it is worth recognizing that skeptics have a track record of overstating the importance of these challenges to the standard model. A few years ago, for example, strong claims were made about the surface temperature record. It is argued that siting issues, for example, a thermometer too close to a building meant that the surface record was hopelessly biased. This was portrayed as an existential threat to the standard model.

Subsequent research, however, has resolved this issue. It is now clear there was never a threat to the standard model at all.

So why do I think that the hiatus, the slow warming of the last decade, is not much of a threat to the standard model? To begin, a lack of a decadal trend in surface temperatures does not mean that the warming has stopped. Observations show that heat continues to accumulate in the bulk of the ocean, indicating continued warming. Also in my written testimony, and in the plot that Senator Whitehouse showed, the surface temperature record shows frequent periods of short cooling, even while it is undergoing a long-term warming trend.

In addition, one of the Senators said the climate models do not predict periods of no warming. That is not correct. Climate models do predict periods where there is no warming.

Now, that does not mean that we understand the hiatus perfectly. And I view the hiatus as an opportunity not as an existential threat. I think short-term climate variability is an area where our understanding could improve and the hiatus will help us to do that. Papers are already coming out, on a monthly basis, it seems, I suspect that in the next few years, our understanding of this phenomena will be greatly improved. At that point, I predict that arguments about the hiatus will disappear just like arguments about the surface temperature record have.

Now, given the success of the standard model, what does it tell us about the impacts of future climate change? Before I begin talking about this, I think it is worth discussing the value of talking about what we know rather than what we don't know. Focus on what is unknown can lead to an inflated sense of uncertainty. For example, we don't know the exact mechanism by which smoking cigarettes causes cancer, nor do we know how many cigarettes you have to smoke to get cancer, nor can we explain why some heavy smokers don't get cancer while some non-smokers do. Based on this, you might conclude that we don't know much about the impacts of smoking, but that is wrong.

So let me just conclude by telling you a few of the certain impacts of climate change. We know the planet is going to warm. That is virtually certain. We know extreme heat events will become more frequent. We know the distribution of rainfall will change. We know the seas will rise. We know the oceans will become more acidic. We can argue about things we don't know, but those are things that are virtually certain.

Thank you.

[The prepared statement of Mr. Dessler follows:]

What we know about climate change

Andrew E. Dessler
Professor of Atmospheric Sciences
Texas A&M University

My name is Andrew Dessler and I am a professor of atmospheric sciences at Texas A&M University. I have been studying the atmosphere since 1988 and I have published in the peer-reviewed literature on climate change, including studies of the cloud and water vapor feedbacks and climate sensitivity. In my testimony, I will review what I think are the most important conclusions the climate scientific community has reached in over two centuries of work.

Let me begin by describing some important points that we know with high confidence — and how that has led me to personally conclude that climate change is a clear and present danger.

1. The climate is warming.

By this I mean by this that we are presently in the midst of an overall increase in the temperature of the lower atmosphere and ocean spanning many decades. This can be seen in Figure 1, which shows the global average surface temperature, and Figure 2, which shows the heat content of the ocean (both figures plot anomalies, expressed in degrees Fahrenheit). A mountain of ancillary data supports these observations of warming: e.g., satellite measurements of the temperature of the lower atmosphere, loss of ice on the planet, observations of sea level rise.

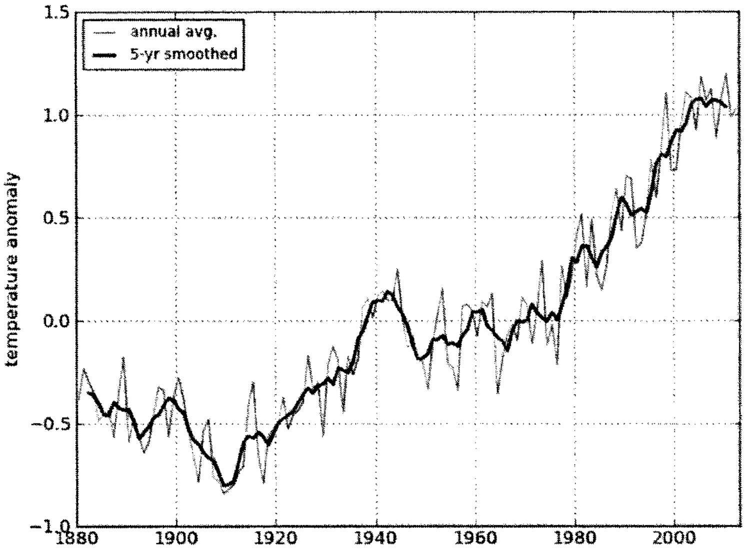

Fig. 1. Global annual average temperature anomaly in °F; the gray line is the annual average and the black line is a smoothed time series. Data are from the NASA GISS Surface Temperature Analysis [Hansen et al., 2010], downloaded from http://data.giss.nasa.gov/gistemp/. Other analyses show nearly identical results.

2. Most of the recent warming is extremely likely due to emissions of carbon dioxide and other greenhouse gases by human activities.

This conclusion is based on several lines of evidence:

a. Humans have increased the amount of carbon dioxide in the atmosphere from 280 parts per million in 1750 to 400 parts per million today. Methane levels have more than doubled over this period, and chlorofluorocarbons did not exist in our atmosphere before humans.

b. The physics of the greenhouse effect is well understood, and it predicts that the increase in greenhouse gases will warm the climate.

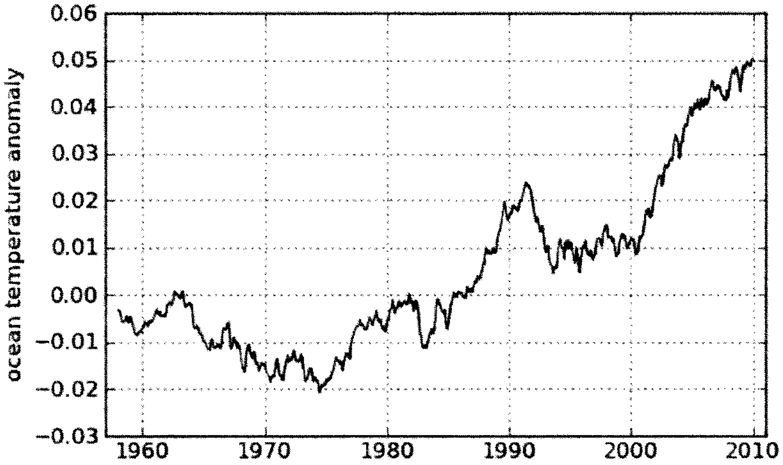

Fig. 2. Ocean temperature anomaly in °F of the entire ocean. Anomalies are calculated relative to the 1970-2000 period (data are from Balmaseda et al. [2013]).

c. The actual amount of warming over the last century roughly matches what is predicted by the standard model[1] of climate. This is shown in Fig. 3.

d. Reconstructions of paleoclimate data over the last 60 million years show that changes in atmospheric carbon dioxide exert a strong control on the climate system.

e. There is no alternative explanation for the recent warming other than an enhanced greenhouse effect due to human activities.

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[1] Following particle physics and cosmology, I'll refer to the mainstream theory of climate science as the *standard model*. A climate model is a single computational realization of the physics embodied in this standard model.

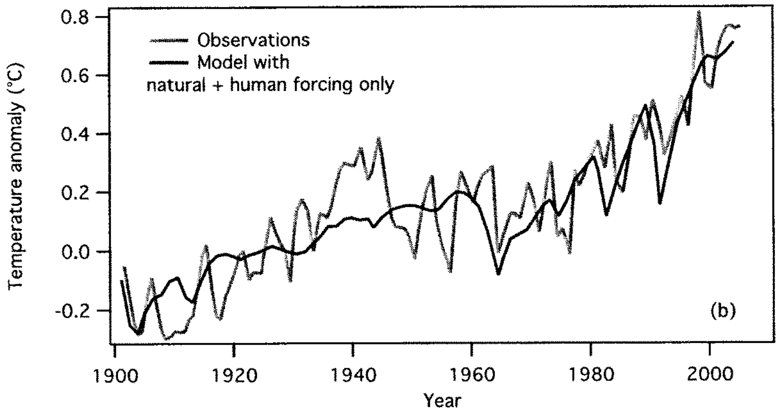

Figure 3. Global mean surface temperature anomalies from the surface thermometer record (gray line), compared with a coupled ocean-atmosphere climate model (black line). The model includes natural forcing and human greenhouse-gas emissions, aerosols, and ozone depletion. Anomalies are measured relative to the 1901-1950 mean. Source: Fig. 3.12 of Dessler and Parson [2010], which was an adaptation of Fig. TS.23, Solomon et al. [2007].

These points fit into a more general context about how science works. Making successful predictions is the gold standard of science. If a theory successfully predicts phenomena that are later observed, one can be confident that the theory captures something essential about the real world system. The standard model has done that. For example, climate scientists predicted in 1967 that the stratosphere would cool while the troposphere warmed as a result of increasing greenhouse gases. This was observed 20 years later. Climate models predicted in the 1970s that the Arctic would warm faster the Antarctic. This has also been subsequently confirmed[2].

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[2] Some of these examples are taken from the 2012 AGU Tyndall Lecture by R. Pierrehumbert, http://fallmeeting.agu.org/2012/events/tyndall-lecture-gc43i-successful-predictions-video-on-demand/

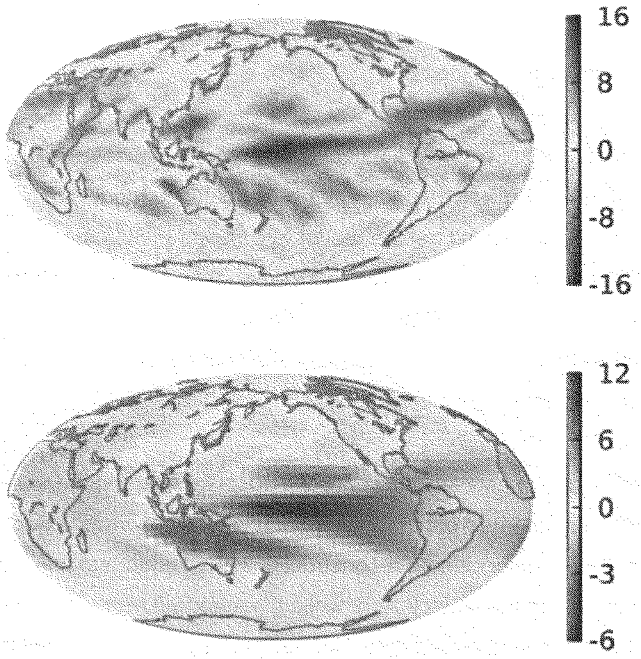

Figure 4. The spatial distribution of the water vapor feedback (W/m^2/K) in (top) observations between 2000 and 2010 and (bottom) control runs of CMIP3 models. Adapted from Fig. 2 of Dessler [2013].

Figure 4 shows the spatial distribution of the water vapor feedback in observations and in climate models. The model calculations are fundamentally a prediction because they were done before the observations were available. The agreement is excellent, and I take from this high confidence in the ability of the models to simulate this feedback. And given the importance of this process in driving climate change, I take this as a strong validation of the standard model generally.

And this is just the tip of the melting iceberg of successful predictions that the climate science community has made using the standard model. Other successful predictions include an increase in energy stored in the ocean, amplification of heating over land during transient warming, etc. The list goes on and on — far too many to catalog here.

The standard model also explains the paleoclimate record. In the 1980s, my colleague Prof. Jerry North was trying to use energy balance models to simulate the ice ages and he just couldn't get the model to simulate those cold periods. Then, in the 1990s, ice core data showed that carbon dioxide was much lower during ice ages. When Prof. North included that reduction of carbon dioxide into the model, voila! — he could suddenly simulate the cold temperatures necessary to account for the ice ages.

In addition, there are many occasions where the observations and the standard model disagreed, and it turned out that the observations were wrong. For example, in the 1980s, paleoclimate reconstructions suggested that the Tropics did not cool much during the last Ice Age, while the standard model found that to be inconsistent with the land-based data. More recent syntheses, however, have shown that the Tropics actually cooled more than previously thought — in good agreement with the standard model.

Another example is the cooling observed in the MSU satellite temperature record in the 1990s. The standard model told us that cooling of the troposphere is inconsistent with surface temperature increases. But after corrections to the satellite data processing were made, they now both show warming. Disagreements between this data set and climate models still exist, but ongoing studies of the satellite record are uncovering more issues in it [e.g., Po-Chedley and Fu, 2012]. I suspect future revisions will bring it into ever-closer agreement with the models.

Thus, we have a standard model of climate science that is capable of explaining just about everything. Naturally, there are some things that aren't necessarily explained by the model, just as there're a few heavy smokers who don't get lung cancer. But none of these are fundamental challenges to the standard model.

An excellent example of a challenge to the standard model is the so-called "hiatus" [Trenberth and Fasullo, 2013]: a lack of warming in the surface temperature record over the last decade or so. This is frequently presented as an existential threat to the standard model, but as I describe below that greatly exaggerates its importance.

To begin, the lack of a decadal trend in surface temperatures does not mean that warming has stopped. Figure 2 shows the continued accumulation of heat in the bulk of the ocean, which is a clear marker of continued warming. And because heat can be stored in places other than at the surface, a lack of surface warming for a decade tells you almost nothing about the underlying long-term warming trends.

More quantitatively, Figure 5 shows surface temperature anomalies between 1970 and 2013. Over this period, the planet warmed rapidly, at a rate of 3°F/century. Also plotted on this figure are short-term trends based on endpoints that were selected to demonstrate short-term cooling trends. As you can see, it's possible to generate a nearly continuous set of short-term cooling trends, even as the climate is experiencing a long-term warming. This would allow someone to claim that global warming had stopped or even that the Earth had entered a cooling period — even though the climate is rapidly warming!

As Fig. 5 shows, the problem in very short temperature trends (like a decade) is that climate variability such as El Niño cycles completely confounds ones ability to see the underlying trend. However, this short-term variability can be removed, and, if one does that, then the hiatus essentially disappears [Foster and Rahmstorf, 2011; Kosaka and Xie, 2013]. Because of this, I judge that there is virtually no merit to suggestions that the "hiatus" poses a serious challenge to the standard model.

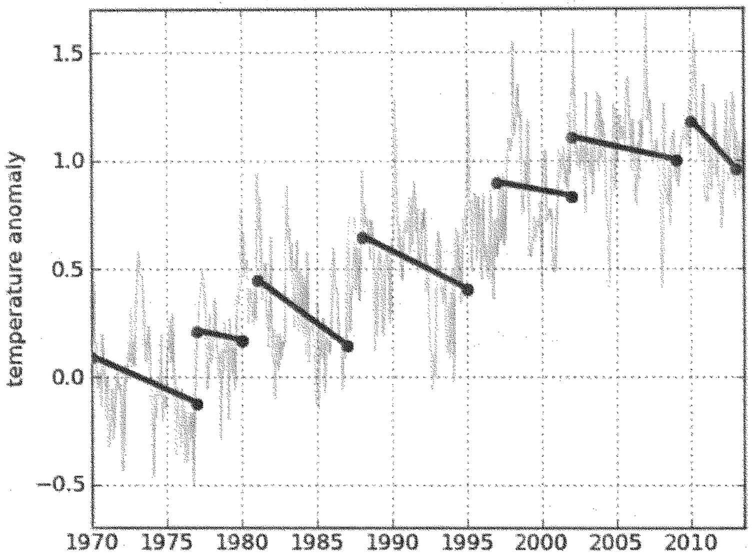

Fig. 5. A plot of monthly and global average surface temperature anomalies (°F) from the GISS Surface Temperature Analysis (gray line) along with selected negative short-term trend lines (black lines). This figure is inspired by SkepticalScience's escalator plot (http://www.skepticalscience.com/graphics.php?g=47)

Nevertheless, it would be wrong for me to claim that the standard model includes a robust understanding of the interaction of ocean circulation, short-term climate variability, and long-term global warming. Viewed that way, the "hiatus" is an opportunity to refine and improve our understanding of these facets of the standard model. Papers are already coming out on this subject [e.g., Kaufmann et al., 2011; Kosaka and Xie, 2013; Solomon et al., 2010] and I suspect that, in a few years, our understanding of this phenomenon will be greatly improved.

What about alternative theories? Any theory that wants to compete with the standard model has to explain all of the observations that the standard model can. Is there any model that can even come close to doing that?

No.

And making successful predictions would help convince scientists that the alternative theory should be taken seriously. How many successful predictions have alternative theories made?

Zero.

Based on everything I discussed above, and more, the Working Group I report recently released by the IPCC concludes that humans are extremely likely to be the cause of most of the warming over the last few decades. Note that this does not claim that humans are the ONLY cause, nor does it claim that we are 100% certain. But given the amount of work that's gone into studying this and the amount of evidence in support of it that has emerged, my view is that this statement is, if anything, conservative.

3. Future warming could be large

As a consequence of our understanding of the climate system, unchecked greenhouse-gas emissions would lead to warming over the 21st century of 4.7-8.6°F[3] (for the global average). Regionally, on land and in the Arctic, the warming is apt to be larger.

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[3] Based on an ensemble of RCP8.5 runs.

These warmings may not sound like much until you realize that the warming since the last ice age — a warming that completely reconfigured the planet — was 9°F-14°F (5-8°C). The upper limits of projected warming over the 21st century would therefore herald a literal remaking of the Earth's environment and our place within it.

4. The impacts of this are profound.

Before I begin talking about impacts, it is worth discussing the value of talking about what we know rather than what we don't know. Focusing on what is unknown can lead to an incorrect perception of uncertainty. For example, we don't know the exact mechanism by which smoking cigarettes causes cancer. Nor do we know how many cigarettes you have to smoke to get cancer. Nor can we explain why some heavy smokers don't get cancer, while some non-smokers do. Based on this, you might conclude that we don't know much about the health impacts of smoking. But that's wrong. Despite these unknowns, it is certain that smoking increases your risk of health problems.

In the climate debate, we can argue about what we know or what we don't know. Arguing about what we don't know can give the impression that we don't know much, even though some impacts are virtually certain.

The virtually certain impacts include:

- increasing temperatures
- more frequent extreme heat events
- changes in the distribution of rainfall
- rising seas
- the oceans becoming more acidic

In my judgment, those impacts and their magnitude are, by themselves, sufficient to compel us to act now to reduce emissions.

And there are a number of impacts that may occur, but are not certain. We may see changes in drought intensity and distribution, and increases in flood frequency. And we have an expectation that hurricanes will get stronger, although their numbers might decrease. And there's always the risk of a surprise, like the Antarctic ozone hole, where some high consequence impact that we never anticipated suddenly arises.

We can argue about these less certain impacts, and scientific research in these areas is very active, but they should not distract us from those that are virtually certain.

In conclusion, things are beginning to change rapidly. More and more frequently it seems we pass another climate milestone — hottest year of the modern temperature record, highest CO_2 in perhaps a million years, etc. Because of inertia in the climate system, every year we don't take action commits us to about 2% more eventual warming [Allen and Stocker, 2014]. In other words, if we start taking appropriate action today, we can limit global warming to 2°C. But, if we wait 10 years to begin to reduce emissions, then the same level of effort will lead to warming of 2.4°C. Time is not our friend in this problem. By the time everyone agrees we have a problem, it is too late to do much about it.

The scientific community has been working on understanding the climate system for nearly 200 years. In that time, a robust understanding of it has emerged. We know the climate is warming. We know that humans are now in the driver's seat of the climate system. We know that, over the next century, if nothing is done to rein in emissions, temperatures will likely increase enough to profoundly change the planet. I wish this weren't true, but it is what the science tells us.

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Senator WHITEHOUSE [presiding]. Thank you very much, Dr. Dessler.

Dr. Lashof, please.

STATEMENT OF DANIEL A. LASHOF, Ph.D., DIRECTOR, CLIMATE AND CLEAN AIR PROGRAM, NATURAL RESOURCES DEFENSE COUNCIL

Mr. LASHOF. Thank you, Mr. Chairman and members of the committee, for the opportunity to appear here today. I want to thank you, Senator Whitehouse, for your work with Senator Boxer and in the Senate Climate Task Force.

Senator WHITEHOUSE. One day I am bipartisan, 1 day.

Mr. LASHOF. So I appreciate that. Actually what I wanted to say is that it does sadden me, actually, that there are no Republicans on that task force. I have appeared before this committee several times over the years, before both Republican and Democratic chairmen. And it has never been as partisan as it is today. CO_2 molecules in the atmosphere trap heat. They don't have party affiliations. It is physics and chemistry, not partisanship, that should be informing the policy that we adopt.

Let me turn to the President's climate plan, because I think it is really a critical step forward. It will put us on the right track to cut dangerous pollution that threatens our health and well-being. It will help communities across the country prepare for more frequent and intense inclement weather. And it will position the United States to provide the leadership that the world needs on this issue.

The central pillar of this plan is a set of standards under existing law, authorized by previous Congresses in the Clean Air Act and other legislation that if implemented ambitiously, can achieve a total reduction in greenhouse gas emissions of 127 percent below 2005 levels by 2020, which is the goal the President has set for the United States. It can do that through four major areas of action. First, power plants are the largest source of carbon pollution in the United States. They are responsible for 40 percent of our CO_2 emissions.

And as Administrator McCarthy discussed, EPA's proposed carbon pollution standards for future power plants, that proposal is based on a careful review of industrial experience with large scale carbon capture technologies.

Now, some have argued that the Energy Policy Act, and we heard this argument today, prevents EPA from setting standards based on CCS because there have been some Government-funded CCS projects. That is incorrect. The Energy Policy Act said that EPA cannot base its standard solely on projects that were funded by the Government. And EPA hasn't done that. It has based its proposal on a wide variety of data.

Just think about the proposition here. If the interpretation that says because the Government has supported some projects that use CCS means EPA can't base standards on CCS, it would be an absurd situation where the Government is investing hundreds of millions of dollars in advanced technology and then we are not allowed to use that technology to improve the environment. That would not make any sense. So we should not do that.

But equally important, neither Government nor private forecasts actually anticipate the construction of any new coal plants in the United States, whether or not carbon pollution standards are established. So in fact, the biggest opportunity to reduce U.S. carbon emissions over the next decade is to set standards for our existing fleet of some 1,500 coal-fired power plants around the country. EPA is scheduled to do that in June.

NRDC's studies of a particular proposal that we offered about how to do that shows that we can actually get big carbon reductions at very low cost. The flexible system-wide approach that we have proposed could reduce emissions by 23 to 30 percent below 2012 levels in 2020, while producing $30 billion to $55 billion in net economic benefits or more.

So that is a very cost effective measure that we should move forward with.

Second, the Administration needs to do more to reduce emissions of methane, particularly from the oil and gas industry. Third, another key initiative is phasing down the use of HFCs, both domestically and internationally. HFCs are hundreds of thousands of times more powerful on a pound for pound basis than carbon dioxide. The U.S. has joined with other countries, including Mexico and Canada, to propose a global phase-down. The President recently reached an agreement with the president of China, committing both countries to such a phase-down. So that is an example of how U.S. leadership can in fact achieve global action on a very important pollutant.

Fourth and finally, we need further action to address the transportation sector, which is the second largest source after power plants. Building on the successful fuel efficiency standards which have been mentioned today, the priority for EPA now is to set stronger standards for freight trucks. And by doing so, the emissions of freight trucks could be reduced by roughly 45 percent by 2025 for new trucks, compared with if we continue to use 2010 technology.

So in conclusion, carbon dioxide emissions have actually declined over the last 5 years as we use energy more efficiently and shift toward cleaner fuels, putting the 17 percent reduction target within reach. And we can achieve that goal through cost-effective standards to reduce CO_2, methane, HFCs from power plants and other large sources. Doing that will create new markets for technological ingenuity and will put the U.S. on track to the much deeper emissions reductions needed for forestall out of control climate disruption and protect our health and the future our children inherit. Thank you.

[The prepared statement of Mr. Lashof follows:]

TESTIMONY OF DANIEL A. LASHOF, Ph.D.

DIRECTOR, CLIMATE AND CLEAN AIR PROGRAM,

NATURAL RESOURCES DEFENSE COUNCIL

HEARING ON

"THE PRESIDENT'S CLIMATE ACTION PLAN"

BEFORE THE COMMITTEE ON ENVIRONMENT & PUBLIC WORKS

U.S. SENATE

JANUARY 16, 2014

Chairman Boxer and members of the Committee, thank you for inviting me to present NRDC's views on federal efforts to address climate change under the President's Climate Action Plan.

We have an obligation to protect our children and future generations from the effects of climate change by reducing emissions of carbon dioxide and other heat-trapping pollutants and by taking sensible steps to prepare for changes in climate that are no longer avoidable. Acting responsibly at home is also a prerequisite for the indispensable leadership that only the United States can provide internationally.

President Obama's historic Climate Action Plan will set us on the right track to cut dangerous pollution that threatens our health and well-being. It will help communities across the country prepare for more frequent and intense extreme weather, such as heat waves, heavy precipitation, drought, coastal flooding, and wildfires. And it will position the United States to provide the leadership the world needs.

The year 2012 was the hottest on record in the continental United States.[1] Severe drought destroyed livestock and livelihoods across the Southwest. Wildfires charred 9.3 million acres of forest.[2] Storm surges amplified by higher sea levels ravaged coastal communities in the East. Overall, extreme weather cost the U.S. economy $140 billion,[3] of which the federal government's share amounted to $96 billion. That's about $1,100 per taxpayer and more than it spent on education or transportation.[4] These staggering sums give us a sense of the cost of inaction. Indeed, they make it clear that inaction is not a responsible option.

The centerpiece of the Climate Action Plan is a set of actions under existing federal laws by the Environmental Protection Agency (EPA), the Department of Energy (DOE) and other agencies to curb heat-trapping pollution and cut energy waste in order to cut total economy-wide

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[1] National Oceanic and Atmospheric Administration (NOAA) and the National Climactic Data Center, *See* http://www.ncdc.noaa.gov/billions/events.

[2] United States Department of Agriculture: USDA Forest Service Update, March 2013, Wildfires of 2012

[3] National Oceanic and Atmospheric Administration (NOAA) and the National Climactic Data Center, *See* http://www.ncdc.noaa.gov/billions/events.

[4] Dan Lashof and Andy Stevenson. Who Pays for Climate Change? U.S. Taxpayers Outspend Private Insurers Three-to-One to Cover Climate Disruption Costs, published by NRDC, May 2013, available at: http://www.nrdc.org/globalwarming/files/taxpayer-climate-costs-IP.pdf.

U.S. greenhouse gas emissions 17% from 2005 levels by 2020.[5] President Obama committed to this benchmark during his first term in office, and reaffirmed it with the announcement of the Climate Action Plan. Other elements of the plan are to prepare for changes in climate that are no longer preventable by supporting community-based preparedness, resilience planning and investment, and developing bilateral and multilateral agreements to reduce climate change pollution worldwide. My testimony focuses primarily on the pollution reduction component of the Climate Action Plan.

To achieve the objectives of the Climate Action Plan the administration will need to take ambitious steps using all the tools at its disposal under current law to reduce carbon dioxide, methane and HFC pollution from major sources. The World Resources Institute (WRI) has identified a "go-getter" scenario in which the administration pursues reductions with the "highest ambition achievable without new congressional action."[6] WRI's analysis shows that meeting the 17% economy-wide emission reduction target will require significant cuts from the largest sources of heat-trapping pollution, particularly: carbon dioxide from power plants, methane from natural gas and oil extraction, and the use of hydrofluourocarbons (HFCs) in industrial and consumer applications. Further carbon dioxide emission reductions from the transportation sector, where the Obama Administration has already made important progress, will also play a role in reaching the 17% reduction goal.

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[5] The President's Climate Action Plan, June 2013, available at: http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf.

[6] Nicholas Bianco, Franz Litz, Kristin Meek, and Rebecca Gasper. Can The U.S. Get There From Here?, published by the World Resources Institute, February 2013, available at: http://www.wri.org/publication/can-us-get-there-here.

Carbon Dioxide Emissions from Power Plants. Power plants in the United States release about 2.2 billion tons of carbon pollution each year.[7] This accounts for 40% of the nation's total carbon footprint, more than any other industry. Currently, power plants operate under federal limits on how much arsenic, mercury and soot they can release, but there are no national limits on dangerous carbon pollution. That's wrong and it needs to change.

The U.S. Supreme Court ruled in 2007[8] and again in 2011 that the Clean Air Act authorizes EPA to set sensible safeguards for carbon dioxide and other greenhouse gas pollutants to protect public health and welfare.[9] Following the law and the president's directive, EPA took an important step forward to carry out the Climate Action Plan when Administrator Gina McCarthy announced EPA's proposal under the Clean Air Act to set federal limits on carbon pollution from future power plants in September last year. That proposal is now open for public comment, following its publication in the Federal Register last week.

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[7] U.S. Energy Information Administration.

[8] *Massachusetts v. EPA*, 549 U.S. 497 (2007). *Massachusetts* directly concerned carbon pollution from motor vehicles. In a companion case stemming out of a 2006 EPA decision refusing to issue standards for CO2 from power plants, the U.S. Court of Appeals for the District of Columbia Circuit directed EPA to take action on power plants in light of the *Massachusetts* decision. *State of New York et al. v. EPA*, No. 06-1322 (Order, Sept. 24, 2007). In 2011 the parties reached a settlement agreement in the *New York* case with a schedule for EPA to act on CO2 standards for both new and existing power plants. www.epa.gov/airquality/cps/settlement.html.

[9] In 2011 the Supreme Court confirmed EPA's responsibility to address carbon pollution from power plants under Section 111 in another climate change case, *American Electric Power vs. Connecticut*, 131 S.Ct. 2527 (2011).

In setting carbon pollution standards, EPA is continuing to do the job of protecting public health and welfare for which it was created more than 40 years ago by a bipartisan Congress. EPA's proposal signals that the era of unlimited carbon pollution is drawing to a close. The proposed standards for new coal plants are based on carbon capture and storage (CCS) technology that is now available and ready for use. EPA has proposed a standard that a system of partial carbon capture can easily achieve. Contrary to claims by naysayers, EPA has a wealth of data showing that CCS has been adequately demonstrated by experience in a variety of applications, including the Boundary Dam plant in Canada, which is designed to outperform the standard. The Kemper plant under construction in Georgia would also meet EPA's proposed standard, providing corroboration of its feasibility.

Electricity from new coal plants—with or without CCS—is considerably more expensive than energy efficiency or electricity supplied by new wind or natural gas combined cycle (NGCC) power plants. As a result, other than completion of a few plants already under construction, neither government nor industry forecasts anticipate construction of any new coal plants in the United States, whether or not carbon pollution standards are established. Nevertheless, EPA notes that there may be a few instances where despite these basic economics companies choose to build something other than the lowest-cost options. In that case, EPA estimates that the cost of power from a coal plant equipped with partial CCS would range from $92 to $110 per Megawatt-hour (MWh), which is comparable to the range for other non-NGCC baseload options of $80 to $130 per MWh. Thus, EPA concluded that the costs of CCS are consistent with the costs of other low-carbon baseload options, and that requiring any new coal plants to meet the standard would not result in significant increases in electricity prices for consumers.[10]

EPA has also announced a schedule for development of guidelines to control carbon pollution from existing power plants, in cooperation with state clean air officials. EPA is conducting an extensive outreach process to provide ample opportunity for all voices to make their views known, ensuring that EPA considers perspectives from the full range of stakeholders. There will be a further opportunity for everyone to comment on EPA's proposed guidelines after they are proposed this June.

NRDC has proposed one option for how such standards could be designed and NRDC's analysis of this approach, using the same power sector model employed by EPA and many power companies, demonstrates that it is feasible to achieve significant emission reductions in carbon dioxide pollution from power plants with benefits for Americans that would far outweigh the modest costs of compliance. In its updated analysis of this proposal, NRDC demonstrated that by implementing guidelines that would permit compliance using a range of power system resources, states could reduce power sector carbon pollution by 23 to 30 percent from 2012 levels in 2020, with net benefits of $30 to $55 billion.[11]

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[10] EPA, Regulatory Impact Analysis: Proposed Standards of Performance for GHG Emissions for New EGUs – Sept 20, 2013, available here: http://www2.epa.gov/sites/production/files/2013-09/documents/20130920proposalria.pdf.

[11] Dan Lashof, Even Bigger Reductions, Even Lower Costs, available at: http://switchboard.nrdc.org/blogs/dlashof/even_bigger_carbon_reductions.html, and NRDC preliminary results of updated analysis. *See* http://switchboard.nrdc.org/blogs/dlashof/NRDC%20Carbon%20Pollution%20Standards%20UPDATED%20ANALYSIS%20BPC%20Workshop%20Dec%202013%20Rev1.pdf.

It is critical that EPA carry out its responsibilities under the Clean Air Act and the Supreme Court's two climate change decisions. NRDC strongly opposes any efforts to repeal its Clean Air Act authority to set standards for carbon pollution, a view shared by two-thirds of registered voters nationwide according to a poll conducted by Hart Research and Chesapeake Beach Consulting in July, 2013.[12] Most recently, Chairman Whitfield and Senator Manchin have introduced a bill that would repeal EPA's authority to carry out carbon pollution standards for existing power plants and would allow the power sector to dictate the standards that could be adopted for new coal plants. This legislation would harm Americans by allowing unlimited excess carbon pollution from power plants for decades; pollution that would stay in the air for centuries, disrupting the climate we depend on to thrive as a modern civilization. Ironically, the legislation would not improve the lot of coal producers or communities in coal country. Rather, it would destroy the interest of U.S. power companies in seriously considering carbon capture and storage systems -- the one technology that could provide a pathway for more sustainable use of coal. The Senate should reject any legislation that would weaken the Clean Air Act or prevent EPA from carrying out the president's Climate Action Plan.

Another poorly-considered effort to block EPA from doing its job is the argument, set forth in a letter from four members of the House of Representatives, that the Energy Policy Act of 2005 prevents EPA from setting standards based on CCS because several CCS coal projects received government funding. This is an incorrect interpretation of the language, and EPA's proposal is in full compliance with the EPAct provision. The 2005 EPAct says that EPA cannot determine that a technology is adequately demonstrated under the Clean Air Act "solely" because the technology was used at projects that have received some government funding. What that means is that if a government-funded project is the *only* evidence EPA has that a technology is viable, EPA cannot set a standard based just on those projects. EPA's conclusion that CCS is adequately demonstrated is based on a number of factors, including the following:

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[12] Hart Research Associates and Chesapeake Beach Consulting, Key Findings From Survey on Carbon Pollution and Climate Change, July 15, 2013. Available at http://docs.nrdc.org/air/files/air_13071801a.pdf

- Experience with large-scale industrial carbon capture going back to the 1930s and large-scale experience with transporting and injecting carbon going back to the 1970s;
- Studies by DOE and others demonstrating that the technologies are fully applicable to the power sector; and
- Several projects that are now moving forward that include the use of CCS.[13]

The fact that some projects have been supported by government funding does not undermine EPA's assessment that the industry has confidence this technology will work in real-world plants, and does nothing to weaken the grounds upon which EPA developed its proposed standard. As these projects go online, they will provide corroboration of the soundness of EPA's "adequately demonstrated" determination, which rests on other evidence.

Methane Emissions from the Oil and Natural Gas Industry. Emissions of methane take place today in the oil and gas sector when natural gas is accidentally leaked or intentionally vented into the air. The chief component of natural gas is methane, which is a highly potent heat-trapping pollutant, at least 34 times more potent than carbon dioxide, on a pound for pound basis. Moreover, natural gas is composed of a number of other harmful pollutants which threaten public health, including volatile organic compounds (VOCs) that cause ground-level smog and hazardous air pollutants (HAPs).

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[13] EPA, Regulatory Impact Analysis: Proposed Standards of Performance for GHG Emissions for New EGUs – Sept 20, 2013, available at: http://www2.epa.gov/sites/production/files/2013-09/documents/20130920proposalria.pdf.

Emissions control technologies and associated practices to significantly limit such pollution exist today, have been tried and tested, and are being used by some oil and gas producers in the field already[14]. These are cost-effective and often profitable, and can generate value for the broader economy by reducing the waste of a valuable resource.[15] But voluntary implementation of these profitable measures has not occurred comprehensively across the industry. Hence, it is important to establish emission control standards that will help to ensure environmental and community safety, while generating economic value. The recently-established EPA New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants for the oil and gas industry[16] are an important first step in the right direction. A recent study led by researchers from the University of Texas confirms that methane emissions from the oil and gas industry are significant, but that control measures such as those required in some cases by these standards can be very effective at reducing these emissions. However, the current standards are limited to natural gas wells and don't address methane emissions directly. Much greater emission reductions can be achieved with more comprehensive and direct regulations.

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[14] Susan Harvey, Vignesh Gowrishankar and Thomas Singer, Leaking Profits: The U.S. Oil and Gas Industry Can Reduce Pollution, Conserve Resources, and Make Money by Preventing Methane Waste, published by NRDC, April 2012, available at http://www.nrdc.org/energy/leaking-profits.asp.

[15] *Id.*

[16] EPA, 40 CFR Parts 60 and 63, Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews: Final Rule, Federal Register, Vol. 77, No. 159, August 16, 2012, Page 49490-49600.

Pursuant to the Climate Action Plan, the Administration will develop an interagency methane strategy that coordinates government action to analyze emissions data, and identify, improve and implement best practices to reduce methane emissions, in collaboration with other sectors of the economy. Specifically, NRDC urges EPA to use its authority under Section 111 of the Clean Air Act to establish standards that require reductions in methane pollution from new and existing sources in the oil and gas industry. This includes establishing standards that specifically regulate methane emissions and cover (i) existing equipment, in addition to new and modified ones; (ii) all types of wells from which natural gas can be produced; and (iii) sources of methane emissions across the entire natural gas supply chain. Such standards will help protect the air we breathe, reduce global warming pollution and prevent the waste of a valuable energy commodity.

The Use and Emission of HFCs. Another key initiative of the Climate Action Plan is phasing down the production and use of HFCs both domestically and internationally. Pound for pound, HFCs are hundreds to thousands of times more efficient at trapping heat than carbon dioxide. The U.S. has already joined Mexico and Canada to propose a global HFC phase-down under the Montreal Protocol and has been party to bilateral and multilateral discussions on proposals to manage HFCs. In a breakthrough in June and September, President Obama reached important agreements with Chinese President Xi committing both countries to phasing down HFCs under the Montreal Protocol. The leaders of the G-20 agreed to similar steps on HFCs in September, and more than 110 governments have endorsed negotiating an HFC agreement.

EPA's analysis of the global benefits of phasing down HFCs shows that the opportunity is considerable—more than 90 billion tons of CO2-equivalent emissions could be avoided by 2050, equaling more than two year's current worldwide emissions of all forms of heat-trapping pollution[17]. EPA has also concluded that less climate-destructive alternatives are available and that there are reasonable phase-down trajectories that could reduce HFC consumption in the U.S. in accordance with schedules proposed during international negotiations.

The President's climate plan directs EPA to cut HFCs in the U.S. using the Clean Air Act's "significant new alternatives program" (SNAP), by identifying and approving climate-friendly chemicals while prohibiting certain uses of the most harmful HFCs. NRDC has petitioned EPA to act quickly on some of the biggest opportunities to reduce HFC use. For example, it is time for EPA to end the use of HFC-134a in new car air conditioners. HFC-134a is 1300 times more powerful in trapping heat than carbon dioxide. It can be replaced with an EPA-approved coolant called HFO-1234yf, which does 1/325th as much climate damage (its potency is just 4 times that of carbon dioxide). Similar opportunities to move to climate-friendlier alternatives exist in commercial refrigeration and a range of other consumer goods. Leadership here at home, and bilaterally with China, will bring big dividends in the Montreal Protocol negotiations.

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[17] Benefits of Addressing HFCs Under the Montreal Protocol, EPA, June 2013, available at: http://www.epa.gov/ozone/downloads/Benefits_of_Addressing_HFCs_Under_the_Montreal_Protocol_6-21-2013.pdf.

Carbon Dioxide Emissions from Vehicles. The transportation sector accounts for roughly one-third of national carbon dioxide emissions, and is the second largest emitter behind power plants. In its first term, the Obama Administration finalized clean car and fuel-efficiency standards for light-duty vehicles and the first-ever fuel-efficiency standards for heavy-duty vehicles.[18] This standard built on the success of the Administration's previous standards for cars and light-duty trucks, and will reduce carbon pollution, address climate change and strengthen the economy. Combined, the Administration's standards will cut carbon emissions from new cars and light trucks in half by 2025, reducing carbon dioxide emissions by 6 billion metric tonnes over the life of the program—more than the total amount of carbon dioxide emitted in the U.S. in 2010. Still, to reach the goal specified in the Climate Action Plan, we must continue to clean up the transportation sector with a special focus in the near term on emissions from freight trucks.

To achieve the necessary long-term reductions in carbon pollution from the transportation sector, the Administration must expand on its successes and continue the progress set in motion in the first term. Freight trucks are the fastest growing source of carbon pollution in the transportation sector. Without tighter standards, the EIA projects that on-road freight trucks will increase carbon dioxide emissions at an average rate of 1.2 percent per year between 2011 and 2040.

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[18] *See* Environmental Protection Agency and National Highway Traffic Safety Administration, "2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards", 77 FR 62624, October 15, 2012, and Environmental Protection Agency and National Highway Traffic Safety Administration, "Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles", 76 FR 57106, September 15, 2011.

Action under the President's Climate Action Plan will put heavy-duty vehicles, including freight trucks, on a cleaner road into the future, with lower fuel consumption that will save drivers money while cutting carbon pollution. The Administration is preparing to release the second phase of the heavy-duty truck fuel efficiency standards as an integral component of the Climate Action Plan. Based on analysis by the National Academies of Science,[19] known cost-effective technologies can achieve fuel consumption and carbon pollution reductions of 5 percent per year, a rate similar to that being achieved with cars and light trucks. A recent NAS report stated,

> "The fuel-saving technologies that are already available on the market generally result in increased vehicle cost, and purchasers must weigh the additional cost against the fuel savings that will accrue. In most cases, market penetration is low at this time. Most fuel saving technologies that are under development will also result in increased vehicle cost, and in some cases, the cost increases will be substantial. As a result, many technologies may struggle to achieve market acceptance, despite the sometimes substantial fuel savings, unless driven by regulation or by higher fuel prices."[20]

Under strong standards, new trucks in 2025 could consume roughly 40 percent less fuel than the average 2010 truck. With these improvements, oil consumption from the on-road U.S. trucking fleet would be cut by 1 million barrels per day in 2030, reducing CO2 emissions by about 200 million tons per year, relative to what would occur if truck technology did not improve.[21]

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[19] National Research Council. Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles . Washington, DC: The National Academies Press, 2010.

[20] *Id.*

Conclusion. U.S. emissions of carbon dioxide and other heat-trapping pollutants have decreased significantly during the last five years as our use of energy has become more efficient and as we have shifted our energy mix toward cleaner fuels. As a result, the United States' commitment to reduce our annual contribution to global warming pollution by 17 percent by 2020 is within reach. Provided that Congress does not prevent EPA and other agencies from doing their jobs, and provided that those agencies are ambitious in implementing the President's Climate Action Plan, we can build on the progress to date and achieve this goal through cost effective standards to reduce carbon dioxide emissions from power plants and vehicles, methane emissions from oil and gas operations, and HFC emissions from the chemical and consumer products industries. Doing so will create new markets for technological ingenuity and will put the United States on track to the much deeper emission reductions needed to forestall out-of-control climate disruption and protect our health and the future our children inherit.

Thank you.

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[21] American Council for Energy-Efficient Economy (ACEEE), "Further Fuel Efficiency Gains for Heavy-Duty Vehicles", September 25, 2013. Available at http://aceee.org/fact-sheet/heavy-duty-fuel-efficiency.

Senator WHITEHOUSE. Thank you very much, Dr. Lashof.

Our next witness is Dr. Curry.

STATEMENT OF JUDITH A. CURRY, Ph.D., PROFESSOR AND CHAIR, SCHOOL OF EARTH AND ATMOSPHERIC SCIENCES, GEORGIA INSTITUTE OF TECHNOLOGY

Ms. CURRY. I would like to thank the committee for the opportunity to present testimony this morning. I am chair of the School of Earth and Atmospheric Sciences at the Georgia Institute of Technology. I have devoted 30 years to conducting research on topics including climate of the Arctic, the role of clouds and aerosols in the climate system and the climate dynamics of extreme weather events.

The premise of the President's climate action plan is that there is an overwhelming judgment of science that anthropogenic global warming is already producing devastating impacts. Anthropogenic greenhouse warming is a theory whose basic mechanism is well understood, but whose magnitude is highly uncertain. Multiple lines of evidence presented in the IPCC Fifth Assessment Report suggests that the case for anthropogenic warming is now weaker than in 2007, when the Fourth Assessment Report was published.

My written testimony documented the following evidence. For the past 16 years, there has been no significant increase in global average surface temperature. There is a growing discrepancy between observations and climate model projections. Observations since 2011 have fallen below the 90 percent envelope of climate model projections.

The IPCC does not have a convincing or competent explanation for this hiatus in warming. There is growing evidence of decreased climate sensitivity to atmospheric carbon dioxide concentrations. And based on expert judgment in light of this evidence, the IPCC Fifth Assessment Report lowered its surface temperature projection relative to the model projections for the period 2016 to 2036.

The growing evidence that climate models are too sensitive to CO_2 has implications for the attribution of late 20th century warming and projections of 21st century climate change. Sensitivity of the climate to carbon dioxide and the level of uncertainty in its value is a key input into the economic models that drive cost benefit analyses, including estimates of the social costs of carbon.

If the recent hiatus in warming is caused by natural variability, then this raises a question as to what extent the warming between 1975 and 2000 can also be explained by natural climate variability. In a recent journal publication, I provided a rationale for projecting the hiatus in warming could extend to the 2030s. By contrast, according to climate model projections, the probability of the hiatus extending beyond 20 years is vanishingly small. If the hiatus does extend beyond 20 years then a very substantial reconsideration will be needed of the 20th century attribution and the 21st century projections of climate change.

Attempts to modify the climate through reducing CO_2 emissions may turn out to be futile. The stagnation in greenhouse warming observed over the past 16 years demonstrates that CO_2 is not a control knob that can fine tune climate variability on decadal and multi-decadal time scales. Even if CO_2 mitigation strategies are successfully implemented and climate model projections are correct, an impact on the climate would not be expected for a number of decades.

Further, solar variability, volcanic eruptions and natural internal climate variability will continue to be sources of unpredictable climate surprises.

As a result of the hiatus in warming, there is growing appreciation for the importance of natural climate variability on multidecadal time scales. Further, the IPCC AR5 and Special Report on Extreme Events published in 2012 find little evidence that supports an increase in most extreme weather events that can be attributed to humans.

The perception that humans are causing an increase in extreme weather events is the primary motivation for the President's climate change plan. However, in the U.S. most types of weather extremes were worse in the 1930s and even in the 1950s than in the current climate, while the weather was overall more benign in the 1970s. The extremes of the 1930s and 1950s are not attributable to greenhouse warming. Rather, they are associated with natural climate variability. And in the case of the Dust Bowl drought and heat waves, also to land use practices. The sense that extreme weather events are now more frequent and intense is symptomatic of pre-1970 weather amnesia.

The frequency and intensity of extreme weather events is heavily influenced by natural climate variability. Whether or not anthropogenic climate change is exacerbating extreme weather events, vulnerability to extreme weather events will continue to increase owing to increasing population and concentration of wealth in vulnerable regions. Regions that find solutions to current problems of climate variability and extreme weather events are likely to be well prepared to cope with any additional stresses from climate change.

Nevertheless, the premise of dangerous anthropogenic climate change is a foundation for a far-reaching plan to reduce greenhouse gas emissions and reduce vulnerability to extreme weather events. Elements of this plan may be argued as important for associated energy policy reasons, economics and/or public health and safety. However, claiming an overwhelming scientific justification for the plan based upon anthropogenic global warming does a disservice both to climate science and to the policy process.

Good judgment requires recognizing that climate change is characterized by conditions of deep uncertainty. Robust policy options that can be justified by associated policy reasons——

Senator WHITEHOUSE. Ms. Curry, in fairness to all the other witnesses, we have tried to keep everybody within a fixed timeframe. You are already a minute over. To the extent you could wrap up, it will be helpful to the committee.

Ms. CURRY. My apologies. Robust policy options that can be justified by associated policy reasons, whether or not anthropogenic climate change is dangerous avoids the hubris of pretending to know what will happen with the 21st century climate.

[The prepared statement of Ms. Curry follows:]

STATEMENT TO THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
OF THE UNITED STATES SENATE

Hearing on
"Review of the President's Climate Action Plan"

16 January 2014

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I am Chair of the School of Earth and Atmospheric Sciences at the Georgia Institute of Technology. I have devoted 30 years to conducting research on topics including climate of the Arctic, the role of clouds and aerosols in the climate system, and the climate dynamics of extreme weather events. As President of Climate Forecast Applications Network (CFAN) LLC, I have worked with decision makers on climate impact assessments, assessing and developing meteorological hazard and climate adaptation strategies, and developing subseasonal climate forecasting strategies to support adaptive management.

I am increasingly concerned that both the climate change problem and its solution have been vastly oversimplified.[1] My research on understanding the dynamics of uncertainty at the climate science-policy interface has led me to question whether these dynamics are operating in a manner that is healthy for either the science or the policy process.[2] I see a growing gap between what science is currently providing in terms of information about climate variability and change, and the information needed to understand and manage associated risks.

My testimony focuses on the following issues of central relevance to the President's Climate Change Program:

- Evidence reported by the IPCC AR5 weakens the case for human factors dominating climate change in the 20th and early 21st centuries.
- Climate change in the U.S. and the importance of natural variability on understanding the causes of extreme events
- Sound science to manage climate impacts requires improved understanding of natural climate variability and its impact on extreme weather events

The IPCC AR5 WGI Report – a weaker case for anthropogenic global warming

Last September, the Intergovernmental Panel on Climate Change (IPCC) released the 5th Assessment Report (AR5) from Working Group I (WGI) – The Physical Science Basis. Over the past two decades, the IPCC's reports have expressed increasingly confident consensus views of the importance of anthropogenic influence on the global climate, as reflected by these statements from the Summary for Policy Makers (SPM):

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[1] Curry, JA and Webster PJ 2011: Climate science and the uncertainty monster. *Bull Amer Meteorol. Soc.*, 92, 1667-1682. http://journals.ametsoc.org/doi/pdf/10.1175/2011BAMS3139.1

[2] Judith Curry, Statement to the Subcommittee on Environment of the U.S. House of Representatives Hearing on Policy Relevant Climate Science in Context, 25 April 2013.

- AR4 (2007): "*Most of the observed increase in global average temperatures since the mid-20th century is **very likely** (>90% confidence) due to the observed increase in anthropogenic greenhouse gases.*" (SPM AR4)

- AR5 (2013): "*It **is extremely likely** (>95% confidence) that human influence has been the dominant cause of the observed warming since the mid-20th century.*" (SPM AR5)

The AR5 statement of 'extremely likely' implies that the overall arguments have strengthened. However, several key elements of the AR5 WGI report point to a weakening of the case for attributing most of the warming to human influences, relative to the previous assessment AR4 (2007):

- Lack of warming since 1998 and the growing discrepancies between observations and climate model projections
- Evidence of decreased climate sensitivity to increases in atmospheric CO_2 concentrations
- Evidence that sea level rise during 1920-1950 is of the same magnitude as in 1993-2012
- Increasing Antarctic sea ice extent

The following summarizes the key points, using the figures and text from the IPCC AR5 WG1 Report and comparing them with the AR4.

Recent hiatus in surface warming and discrepancies with climate models

The IPCC AR5 notes the lack of surface warming since 1998:

> "*[T]he rate of warming over the past 15 years (1998–2012) [is] 0.05 [–0.05 to +0.15] °C per decade which is smaller than the rate calculated since 1951 (1951–2012) [of] 0.12 [0.08 to 0.14] °C per decade.*" (AR5 SPM)

The significance of this hiatus in warming since 1998 arises from comparison with climate model projections. The IPCC AR4 stated:

> "*For the next two decades, a warming of about 0.2°C per decade is projected for a range of SRES emission scenarios.*" (AR4 SPM)

The fifth phase of the Coupled Model Intercomparison Project (CMIP5)[3] has produced a multi-model dataset that includes long-term simulations of twentieth-century climate and projections for the twenty-first century and beyond. CMIP5 provides the climate model simulations used in the AR5. Figure 1 summarizes the near-term projections from CMIP5 of global mean surface temperature anomalies. The observed global temperature record, particularly since 2005, are on the low end of the model envelope that contains 90% of the climate model simulations, and observations in 2011-2012 are below the 5-95% envelope of the CMIP5 simulations. Overall, the trend in the model simulations is substantially larger than the observed trend over the past 15 years.[4]

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[3] Taylor, Karl E., Ronald J. Stouffer, Gerald A. Meehl, 2012: An Overview of CMIP5 and the Experiment Design. *Bull. Amer. Meteor. Soc.*, 93, 485–498. http://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-11-00094.1

[4] A revised version of Figure 11.25 from the AR5 WG1 Report is given by Ed Hawkins http://www.climate-lab-book.ac.uk/2013/updates-to-comparison-of-cmip5-models-observations/, which also includes the new surface temperature climatology by Cowtan and Way (2013) *Roy. Meteorol. Soc.* http://onlinelibrary.wiley.com/doi/10.1002/qj.2297/abstract. It is seen that this new climatology is slightly warmer, but does not significantly change the climate model discrepancies with observations

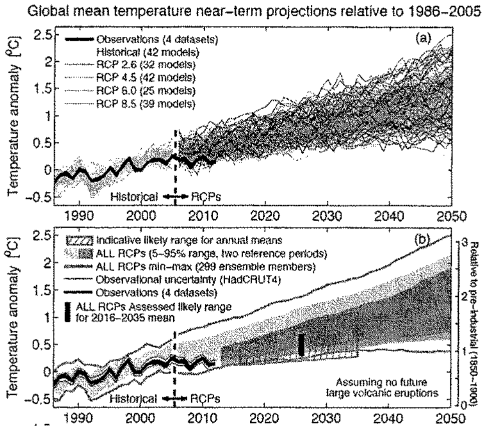

Figure 1. Comparison the global average surface temperatures from the surface temperature data sets with the CMIP5 simulations. The red-hatched region shows the likely range for annual mean global surface teperature during the period 2016–2035 based on expert judgment. From Figure 11.25 (IPCC AR5 WG1).

Regarding projections for the period 2012-2035, the CMIP5 5-95% trend range is 0.11°C–0.41°C per decade. The IPCC then cites 'expert judgment' as the rationale for lowering the projections (indicated by the red hatching):

> *"However, the implied rates of warming over the period from 1986–2005 to 2016–2035 are lower as a result of the hiatus: 0.10°C–0.23°C per decade, suggesting the AR4 assessment was near the upper end of current expectations for this specific time interval."* (AR5 Chapter 11)

This lowering of the projections (and decreasing the trend) relative to the results from the raw CMIP5 model simulations was done based on expert judgment that some models are too sensitive to anthropogenic forcing.

While the near term projections were lowered relative to the CMIP5 simulations, the AR5 states with regards to extended-range warming:

> *"Increase of global mean surface temperatures for 2081–2100 relative to 1986–2005 is projected to likely be in the ranges derived from the concentration driven CMIP5 model simulations."* (AR5 Chapter 12)

In Table SPM.2, which provides a summary of the CMIP5 simulations for the different emission scenarios for the periods 2046-2065 and 2081-2100, a note in the caption states:

> *"The likely ranges for 2046−2065 do not take into account the possible influence of factors that lead to the assessed range for near-term (2016−2035) global mean surface temperature change that is lower than the 5−95% model range, because the influence of these factors on longer term projections has not been quantified due to insufficient scientific understanding."* (AR5 SPM)

This statement acknowledges that there is an uncertainty and possible bias leading to high values that has not been taken into account due to lack of understanding. Although this statement is made explicitly only for the period 2046-2065, the issue is also not accounted for in the later period. This kind of *insufficient scientific understanding* is not a good basis for high confidence in the climate model simulations and projections.

Regarding the current hiatus, the IPCC concludes that:

> *". . . the hiatus is attributable, in roughly equal measure, to a decline in the rate of increase in effective radiative forcing (ERF) and a cooling contribution from internal variability (expert judgment, medium confidence). The decline in the rate of increase in ERF is primarily attributed to natural (solar and volcanic) forcing but there is low confidence in quantifying the role of forcing trend in causing the hiatus, because of uncertainty in the magnitude of the volcanic forcing trend and low confidence in the aerosol forcing trend."* (AR5 Chapter 11)

In summary:

- After expecting a global mean surface temperature increase of 0.2°C per decade in the early decades of the 21st century based on climate model simulations and statements in the AR4, the warming over the past 15 years is only ~0.05°C.
- The IPCC AR5 bases its surface temperature projection of 0.10 to 0.23°C per decade for the period 2016-2036 on expert judgment, which is lowered relative to the climate model results that predict substantially greater warming
- The IPCC does not have a convincing or confident explanation for the current hiatus in warming.

Sensitivity of climate to doubled CO2 concentrations

The equilibrium climate sensitivity (ECS) is defined as the change in global mean surface temperature at equilibrium that is caused by a doubling of the atmospheric CO_2 concentration. The IPCC AR4 conclusion on climate sensitivity is stated as:

> *"The equilibrium climate sensitivity. . . is likely to be in the range 2°C to 4.5°C with a best estimate of about 3°C and is very unlikely to be less than 1.5°C. Values higher than 4.5°C cannot be excluded."* (AR4 SPM)

The IPCC AR5 conclusion on climate sensitivity is stated as:

> *Equilibrium climate sensitivity is likely in the range 1.5°C to 4.5°C (high confidence), extremely unlikely less than 1°C (high confidence), and very unlikely greater than 6°C (medium confidence)* (AR5 SPM)

The bottom of the 'likely' range has been lowered from 2 to 1.5°C in the AR5, whereas the AR4 stated that ECS is very unlikely to be less than 1.5°C. It is also significant that the AR5 does not cite a best estimate, whereas the AR4 cites a best estimate of 3°C. Further the AR5 finds values of ECS exceeding 6°C to be very unlikely, whereas the AR4 did not have sufficient confidence to identify an upper bound at this confidence level. The stated reason for not citing a best estimate in the AR5 is the substantial discrepancy between observation-based estimates of ECS (lower), versus estimates from climate models (higher). Figure 1 of Box 12.2 in the AR5 WG1 report shows that 11 out of 19 observational-based studies of ECS have values below 1.5°C in the range of their ECS probability distribution.

Hence the AR5 reflects greater uncertainty and a tendency towards lower values of the ECS than the AR4. The discrepancy between observational and climate model-based estimates of climate sensitivity is substantial and of significant importance to policymakers -- sensitivity, and the level of uncertainty in its value, is a key input into the economic models that drive cost-benefit analyses and estimates of the social cost of carbon.

Sea level rise

In the AR5 SPM, the following statements are made regarding sea level rise:

> *"It is very likely that the mean rate of global averaged sea level rise was 1.7 [1.5 to 1.9] mm* yr^{-1} *between 1901 and 2010, 2.0 [1.7 to 2.3] mm* yr^{-1} *between 1971 and 2010 and 3.2 [2.8 to 3.6] mm* yr^{-1} *between 1993 and 2010.* ***It is likely that similarly high rates occurred between 1920 and 1950."*** (AR5 SPM)
>
> *"It is* ***very likely*** *that there is a substantial contribution from anthropogenic forcings to the global mean sea level rise since the 1970s."* (AR5 SPM)

The rate of global mean sea level as portrayed in AR5 is shown in Figure 2 below.

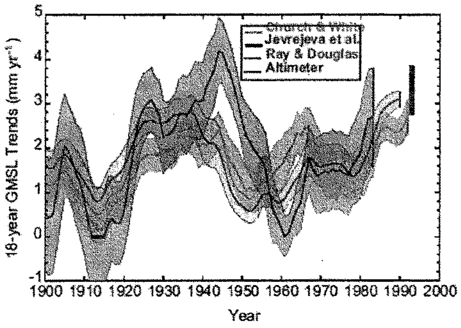

Figure 2. 18-year trends of global mean sea level rise estimated at 1-year intervals. The time is the start date of the 18-year period, and the shading represents the 90% confidence. The estimate from satellite altimetry is also given, with the 90% confidence given as an error bar. [AR5 WGI Figure 3.14]

In AR5 SPM there are significant changes relative to the AR4 WG1 SPM concerning the estimated contributions to sea level rise from different sources:

Table 1: Contributions to sea level rise from different sources (mm per year)

	AR4 (1993-2003)	AR5 (1993-2010)
Thermal expansion	1.6	1.1
Glaciers and ice caps	0.77	0.76
Greenland ice sheet	0.21	0.33
Antarctic ice sheet	0.21	0.27
Land water storage	---	0.38
Sum	0.28	0.28
Observed sea level rise	3.1	3.2

Thermal expansion is one third smaller in AR5 and land water storage with a substantial amount is completely new in AR5, while the sum of these sources remained constant. With regards to land water storage, a recent paper[5] estimated that the human impacts, particularly unsustainable ground water use, have contributed a sea-level rise of about 0.77 mm yr^{-1} between 1961 and 2003, which is twice as large as the estimate used in the AR5.

Global sea level has been rising for the past several thousand years. The key issue is whether the rate of sea level rise is accelerating owing to anthropogenic global warming. It is seen that the rate of rise during 1930-1950 was comparable to, if not larger than, the value in recent years. Hence the data does not seem to support the IPCC's conclusion of a substantial contribution from anthropogenic forcings to the global mean sea level rise since the 1970s. Further, the growing realization of the importance of land water storage to sea level rise is diminishing the percentage of sea level rise that is associated with warming. Better understanding of natural versus anthropogenic components of sea level rise and the impacts of land use (especially groundwater depletion) on sea level rise is needed to effectively evaluate policy responses to sea level rise.

Sea ice

The IPCC AR5 reports the following trends in sea ice:

> *"Continuing the trends reported in AR4, the annual Arctic sea ice extent* ***decreased*** *over the period 1979–2012: the rate of this decrease was very likely between 3.5 and 4.1% per decade* (AR5 SPM)
>
> *"It is very likely that the annual Antarctic sea ice extent* ***increased*** *at a rate of between 1.2 and 1.8% per decade between 1979 and 2012.* (AR5 SPM)

AR5 Chapter 10 states:

> *"Anthropogenic forcings are very likely to have contributed to Arctic sea ice loss since 1979. There is low confidence in the scientific understanding of the observed increase in Antarctic sea ice extent since 1979, due to the incomplete and competing scientific explanations for the causes of change and low confidence in estimates of internal variability."* (AR5 Chapter 10)
>
> *"Arctic temperature anomalies in the 1930s were apparently as large as those in the 1990s and 2000s. There is still considerable discussion of the ultimate causes of the warm temperature anomalies that occurred in the Arctic in the 1920s and 1930s."* (AR5 Chapter 10)

The increase in Antarctic sea ice is not understood and is not simulated correctly by climate models. Further, Arctic surface temperature anomalies in the 1930's were as large as the recent temperature anomalies. Notwithstanding the simulations by climate models that reproduce the decline in Arctic sea ice, more convincing arguments regarding causes of sea ice variations requires understanding and ability to simulate sea ice variations in *both* hemispheres.

A key issue in understanding the recent decline in Arctic sea ice extent is to understand to what extent the decline is caused by anthropogenic warming versus natural climate variability.

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[5] Pokhrel et al. 2013: Model estimates of sea-level change due to anthropogenic impacts on terrestrial water storage. *Nature Geoscience.* http://www.nature.com/ngeo/journal/v5/n6/full/ngeo1476.html

Analysis[6] of the CMIP3 and CMIP5 simulations found that about 41% of the recent sea ice decline could be attributed to anthropogenic warming from the CMIP3 models, and about 60% from the CMIP5 models. A recent paper seeks to interpret the multi-decadal natural variability component of the Arctic sea ice in context of a 'stadium wave'.[7] This paper suggests that a transition to recovery of the natural variability component of the sea ice extent has begun in the Eurasian Arctic sector, and that the recovery will reach its maximum extent circa 2040.

Summary

Multiple lines of evidence presented in the IPCC AR5 WG1 report suggest that the case for anthropogenic warming is weaker than the previous assessment AR4 in 2007. Anthropogenic global warming is a proposed theory whose basic mechanism is well understood, but whose magnitude is highly uncertain. The growing evidence that climate models are too sensitive to CO_2 has implications for the attribution of late 20th century warming and projections of 21st century climate.

If the recent warming hiatus is caused by natural variability, then this raises the question as to what extent the warming between 1975 and 2000 can also be explained by natural climate variability.

The stadium wave hypothesis[8] predicts that the warming hiatus could extend to the 2030's. Based upon climate model projections, the probability of the hiatus extending beyond 20 years is vanishing small. If the hiatus does extend beyond 20 years, then a very substantial reconsideration will be needed of the 20th century attribution and the 21st century projections of climate change.

Climate change in the U.S.

The prospect of increased frequency and severity of extreme weather in a warmer climate is proposed as potentially the most serious near term impact of climate change. Metaphors such as climate change 'loading the dice' for severe weather or causing 'weather on steroids' are frequently used to communicate an elevated probability of extreme weather events as a result of human-caused climate change. Because of their large socioeconomic impacts, weather catastrophes act as focusing events for the public, in the politics surrounding the climate change debate. The perception that humans are causing an increase in extreme weather events is a primary motivation for the President's Climate Change Plan:

> *". . . climate change is no longer a distant threat – we are already feeling its impacts across the country and the world. Last year was the warmest year ever in the contiguous United States and about one-third of all Americans experienced 10 days or more of 100-degree heat. The 12 hottest years on record have all come in the last 15 years. . . And increasing floods, heat waves, and droughts have put farmers out of business, which is already raising food prices dramatically."*

In 2012, the IPCC published a *Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (SREX)[8]. The following draws from the SREX, the IPCC AR5 WG1 report, and climatic data for the U.S. provided by NOAA and the Berkeley Earth Surface Temperature project.

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[6] Stroeve, J. et al. 2012: Trends in Arctic sea ice extent from CMIP3, CMIP5 and observations. Geophys. Res. Lett., 39, L16502

[7] Wyatt, MG and JA Curry, 2013: Role for Eurasian Arctic shelf sea ice in a secularly varying hemispheric climate signal during the 20th century. Climate Dynamics, http://curryja.files.wordpress.com/2013/10/stadium-wave1.pdf

[8] https://ipcc-wg2.gov/SREX/

U.S. surface temperatures

Figure 3 shows the latest analysis of annual surface temperature anomalies for the continental U.S. since 1850, from Berkeley Earth Surface Temperature Project. The year 2012 was the warmest year on record for the U.S., followed by 2006, 1998, and 1934. Globally, 2012 ranked as the 8th or 9th warmest year, with Argentina also recording its warmest year. It is seen that the annual average temperature for 2013 was relatively cool, and ranked only as the 42nd warmest year for the continental U.S.

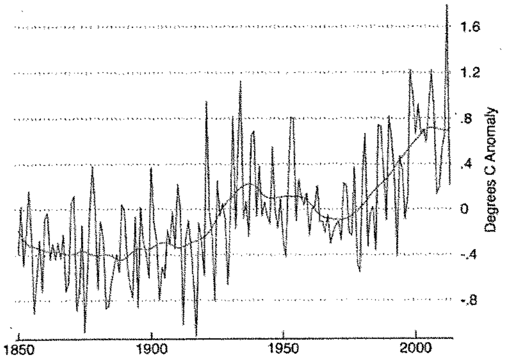

Figure 3. Annual average surface temperature anomalies for the continental U.S. since 1850. Data and plot from the Berkeley Earth Surface Temperature Project.

Summer heat extremes

Figure 4 shows the number of daily record high summertime daily maximum temperatures (T_{max}) and minimum temperatures (T_{min}) for the continental U.S. since 1895. The number of daily record T_{max} shows no trend, with a strong maximum during the 1930's. The number of daily record T_{min} also shows a maximum in the 1930's, but also shows an overall increasing trend since the 1970's.

The EPA also cites evidence that summertime heat waves were frequent and widespread in the 1930s, and these remain the most severe heat waves in the U.S. historical record.[9] Overall, any evidence of an anthropogenic effect (greenhouse gases, aerosols, land use) on summertime record high temperatures is more likely to be seen in T_{min} than in T_{max}.

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[9] http://www.epa.gov/climatechange/images/indicator_figures/high-low-temp-figure1-2013.gif

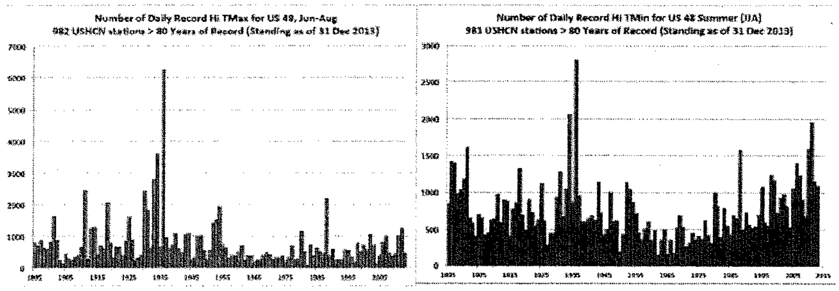

Figure 4. Number of daily record high T_{max} (red; left) and T_{min} (blue; right) for the summer season (Jun-Aug) for the continental U.S. Data obtained from 981 USHCN stations with surface temperature records exceeding 80 years and standing as of 12/31/13. Figure courtesy of John Christy, University of Alabama Huntsville.

Winter cold extremes

Figure 5 shows the number of daily record wintertime maximum (T_{max}) and minimum (T_{min}) temperatures for the continental U.S. since 1895. A declining trend in wintertime T_{min} records is seen, with very few records for the period 1997-2013. The wintertime T_{max} records do not show any particular trend, with a cluster of records during the 1930's and the 1980's standing out years with the largest number of wintertime T_{max} records.

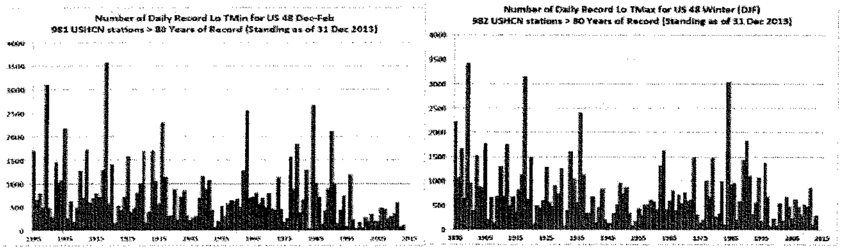

Figure 5. Number of daily record low T_{min} (top) and T_{max} (bottom) for the winter season (Dec-Feb) for the continental U.S. Data obtained from 981 USHCN stations with surface temperature records exceeding 80 years, and standing as of 12/31/13. Figure courtesy of John Christy, University of Alabama Huntsville.

Last week, the central and eastern U.S. was in the midst of a major cold wave, with large regions dropping below 0°F and wind chills reaching below -30°F. On one hand, some have stated that such cold is clear evidence that global warming is nonsense. On the other, some have argued that the cold wave is another example of extreme weather forced by increased greenhouse gases. Neither statement is supported by the evidence. There is nothing in Figure 5 to suggest that extreme cold air outbreaks (as reflected in record temperatures) are becoming more frequent in the U.S. With regards to the polar vortex, such circulation patterns are not uncommon. Analogues for a similar pattern and associated major wintertime cold air outbreak occurred in 1977, 1978, 1985, 1993 and 1994.[10]

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[10] personal communication, Joe Bastardi of WeatherBell

Precipitation

Extremes in precipitation (drought and heavy rainfall events) are shown in Figure 6. These data reflect NOAA's Climate Extreme Index, which is calculated as the percentage of the U.S. being falling in the upper or lower tenth percentile of the local period of record. Drought is represented by the Palmer Drought Severity Index (PDSI) and heavy rainfall events are characterized from extremes in 1-day precipitation.

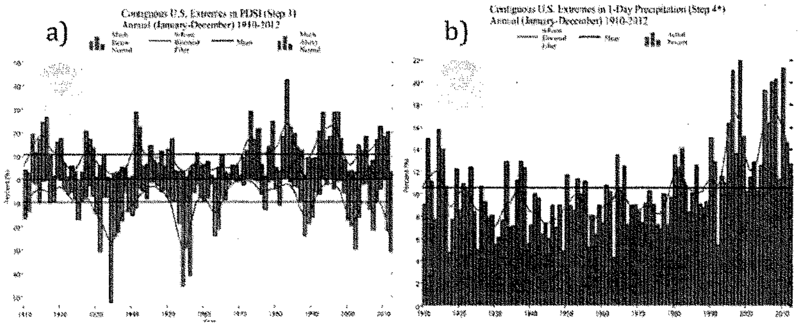

Figure 6. Annual frequency (%) of extremes in a) the Palmer Drought Severity Index; and b) extremes in 1-day precipitation. Figures obtained from the NOAA NCDC Climate Extremes Index
a) http://www.ncdc.noaa.gov/extremes/cei/graph/3/01-12 b) http://www.ncdc.noaa.gov/extremes/cei/graph/4/01-12

Figure 6a shows that the most extreme droughts were observed in the 1930's and 1950's. The largest positive extremes (wet) are seen since the 1980's. Figure 6b shows the historical distribution of extremes in 1-day rainfall rates. The highest values are clustered in the period since the 1990. It is unclear whether an increase in flooding can be attributed to the increase in extreme rainfall rates owing to the confounding factors of land use change and urbanization. Combined, Figures 6a and 6b present a picture of increasing precipitation and decreasing frequency of extreme drought.

Sea level rise

As cited above, the IPCC AR5 finds a mean global sea level rise of 3.2 [2.8 to 3.6] mm yr^{-1} between 1993 and 2010, and states that there is very likely a substantial contribution from anthropogenic forcings since the 1970s. In many locations, local factors dominate the sea level variations: rising or subsidence from geologic processes, coastal engineering projects, and human impacts on terrestrial water storage including reservoir operation, ground water use and irrigation.

Figure 7 shows local trends in sea level for the U.S. coast. The predominant arrow color is green (0-3 mm/yr), which is nominally below mean global sea level rise. In Florida, sea level is rising at a rate of only 0.75 to 2.4 mm/yr. By contrast, Louisiana sea level rise exceeds 9 mm/yr. The Mid Atlantic coast has sea level rises ranging from 2.5 to 6 mm/yr. Along the coast of the Gulf of Alaska, sea level is *decreasing* at rates exceeding -10 mm/yr.

Many locations have a rate of sea level rise that differs significantly from the global average value. This occurs owing to the dominance of local factors (geologic and/or land use) on sea level rise. Projected rates of sea level rise for the period 2081-2100 depend on emission scenarios, and range from 3 to 15 mm/yr, with most scenarios projecting a substantial acceleration over the current rate. Sea level rise projections using climate models may be too high owing to biases in sensitivity to greenhouse gases, and projections based on semi-empirical models may be too high owing to insufficient consideration given to land water storage. Assessing vulnerability of individual locations to anthropogenically-induced sea level rise also needs to account for local factors (e.g. geologic and land use) driving sea level rise as well as natural variability in sea level rise.

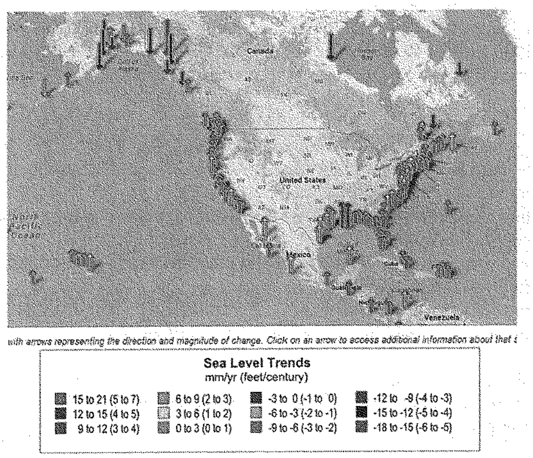

Figure 7. Local trends in sea level determined from tide stations, with arrows representing the direction and magnitude of the change. http://tidesandcurrents.noaa.gov/sltrends/

Summary

With regards to the impacts of climate change on the continental U.S., the following trends are seen over the past century are seen:

- declining frequency of wintertime cold extremes
- declining frequency of drought
- increasing frequency of heavy rain events
- increasing sea level rise that is dominated by local factors in many locations

There is a large component of natural variability seen in the 100+ year data record particularly for drought and heat waves, each of which had maximum extremes during the 1930's. Sea level rise also shows a maxima during the 1930's to 1940's.

There is a widespread perception that extreme weather events are worsening, as reflected by this statement from President Obama's State of the Union address:

> *"Heat waves, droughts, wildfires, and floods – all are now more frequent and intense. We can choose to believe that Superstorm Sandy, and the most severe drought in decades, and the worst wildfires some states have ever seen were all just a freak coincidence. Or we can choose to believe in the overwhelming judgment of science – and act before it's too late."*[11]

In the U.S., most types of weather extremes were worse in the 1930's and even in the 1950's than in the current climate, while the weather was overall more benign in the 1970's. This sense that extreme weather events are now more frequent and intense is symptomatic of 'weather amnesia' prior to 1970. The extremes of the 1930's and 1950's are not attributable to greenhouse warming and are associated with natural climate variability (and in the case of the dustbowl drought and heat waves, also to land use practices).

There is no *a priori* scientific reason to prefer the climate of the 1930's, the 1970's, the current climate, or a climate that is 1-2°C warmer than present. Which climate is preferable from a socioeconomic perspective:

- the current warmer climate with fewer extreme cold air outbreaks versus the climate of the 1970's with fewer heat waves?
- the current climate with fewer severe droughts and more frequent heavier rainfall, versus prior periods with overall less rainfall?
- the present climate, or a future climate that is 1-2°C warmer with overall more rainfall and less frequent drought, fewer extreme cold events but more frequent heat waves?

The preference undoubtedly varies regionally. The key issues are the adaptive capacity of societies, and the unresolved moral dilemma of how to balance obligations towards future generations against obligations to the current generation, which underlies economic debates around the discount rate.

Sound science in support of good judgment

The premise of President Obama's Climate Action Plan is that there is an overwhelming judgment of science that anthropogenic global warming is already producing devastating impacts, which is summarized by this statement from the President's Second Inaugural Address:

> *Some may still deny the overwhelming judgment of science, but none can avoid the devastating impact of raging fires and crippling drought and more powerful storms.*

This premise is not strongly supported by the scientific evidence:

- the science of climate change is not settled, and evidence reported by the IPCC AR5 weakens the case for human factors dominating climate change in the 20th and early 21st centuries
- with the 15+ year hiatus in global warming, there is growing appreciation for the importance of natural climate variability
- the IPCC AR5 and SREX find little evidence that supports an increase in most extreme weather events that can be attributed to humans, and weather extremes in the U.S. were generally worse in the 1930's and 1950's than in recent decades.

Not only is more research needed to clarify the sensitivity of climate to carbon dioxide and understand the limitations of climate models, but more research is needed on solar variability, sun-climate connections, natural internal climate variability and the climate dynamics of extreme weather events. Improved understanding of these aspects of climate variability and change is needed to help government officials, communities, and businesses better understand and manage the risks associated with climate change.

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[11] http://www.whitehouse.gov/state-of-the-union-2013

Nevertheless, the premise of dangerous anthropogenic climate change is the foundation for a far-reaching plan to reduce greenhouse gas emissions and reduce vulnerability to extreme weather events. Elements of this Plan may be argued as important for associated energy policy reasons, economics, and/or public health and safety. However, claiming an overwhelming scientific justification for the Plan based upon anthropogenic global warming does a disservice both to climate science and to the policy process.

Motivated by the precautionary principle to avoid dangerous anthropogenic climate change, attempts to modify the climate through reducing CO_2 emissions may turn out to be futile. The stagnation in greenhouse warming observed over the past 15+ years demonstrates that CO_2 is not a control knob on climate variability on decadal time scales. Even if CO_2 mitigation strategies are successful and climate model projections are correct, an impact on the climate would not be expected for a number of decades owing to the long lifetime of CO_2 in the atmosphere and thermal inertia driven by the ocean (AR5 WG1 FAQ 12.3); solar variability, volcanic eruptions and natural internal climate variability will continue to be sources of unpredictable climate surprises.

Specifically with regards to most extreme weather events, their frequency and intensity is heavily influenced by natural internal variability. Whether or not anthropogenic climate change is exacerbating extreme weather events, vulnerability to extreme weather events will continue owing to increasing population and wealth in vulnerable regions. Climate change (regardless of whether the primary cause is natural or anthropogenic) may be less important in driving vulnerability in most regions than increasing population, land use practices, and ecosystem degradation. Regions that find solutions to current problems of climate variability and extreme weather events and address challenges associated with an increasing population are likely to be well prepared to cope with any additional stresses from climate change.

Short Biography

Judith Curry
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Dr. Judith Curry is Professor and Chair of the School of Earth and Atmospheric Sciences at the Georgia Institute of Technology and President of Climate Forecast Applications Network (CFAN). Dr. Curry received a Ph.D. in atmospheric science from the University of Chicago in 1982. Prior to joining the faculty at Georgia Tech, she held faculty positions at the University of Colorado, Penn State University and Purdue University. Dr. Curry's research interests span a variety of topics in climate; current interests include air/sea interactions, climate feedback processes associated with clouds and sea ice, and the climate dynamics of hurricanes. She has published over 190 journal articles and is author of the books *Thermodynamics of Atmospheres and Oceans* and *Thermodynamics, Kinetics and Microphysics of Clouds.* She is also Editor of the *Encyclopedia of Atmospheric Sciences*. She is a prominent public spokesperson on issues associated with the integrity of climate research, and is proprietor of the weblog Climate Etc. judithcurry.com. Dr. Curry currently serves on the DOE Biological and Environmental Research Advisory Committee, and has recently served on the NASA Advisory Council Earth Science Subcommittee, National Academies Climate Research Committee and the Space Studies Board and the NOAA Climate Working Group. Dr. Curry is a Fellow of the American Meteorological Society, the American Association for the Advancement of Science, and the American Geophysical Union.

Financial declaration

Funding sources for Curry's research have included NSF, NASA, NOAA, DOD and DOE. Recent contracts for CFAN include a DOE contract to develop extended range regional wind power forecasts and a DOD contract to predict extreme events associated with climate variability/change having implications for regional stability. CFAN contracts with private sector and other non-governmental organizations include energy and power companies, reinsurance companies, other weather service providers, NGOs and development banks. Specifically with regards to the energy and power companies, these contracts are for medium-range (days to weeks) forecasts of hurricane activity and landfall impacts. CFAN has one contract with an energy company that also includes medium-range forecasts of energy demand (temperature), hydropower generation, and wind power generation. CFAN has not received any funds from energy companies related to climate change or any topic related to this testimony.

For more information:

http://curry.eas.gatech.edu/
http://www.cfanclimate.com/
http://judithcurry.com

Responses to Senator Sessions' follow-up questions from the January 16 Hearing

Judith Curry
3/15/14

1. On November 14, 2012, President Obama stated that "the temperature around the globe is increasing faster than was predicted even 10 years ago." Again, on May 29, 2013, the President stated: "We also know that the climate is warming faster than anybody anticipated five or 10 years ago." But the actual temperature data shows that is not correct. Do you believe the President was correct when mailing these specific assertions?

I do not think that the President was correct in making these assertions. Figure 1 of my testimony shows that the global average surface temperature is lower than what was predicted.

2. Dr. Curry, your written testimony explains: "The perception that humans are causing an increase in extreme weather events is a primary motivation for the President's Climate Change Plan." Like President Obama, Al Gore also recently asserted that "all weather events are now affected by global warming pollution." Our Committee Chairman, Sen. Boxer, even called last year's Superstorm Sandy "evidence of climate change mounting around us." But we've looked closely at the facts, and I don't think these claims are supportable. Do you agree? Are we experiencing more extreme temperature highs and lows than in prior decades, such as the 1930s? Are we experiencing more droughts? Are we seeing increasing sea level rises globally?

All weather events may be affected to some extent by global warming, but that does not mean that global warming is making extreme events worse or more frequent.

Regarding temperature highs and lows in the U.S., Figures 4 and 4 in my testimony show that summer high temperature extremes were more prevalent in the 1930's. Winter time low temperature records show a general decline over the last decade.

In the U.S., droughts in the U.S. were substantially worse in the 1930's and 1950's, which is shown in Figure 6 of my testimony.

As shown in Figure 7 of my testimony, sea level is rising globally, although the rate of sea level rise was as large or larger in the 1930's and 1940's.

Senator WHITEHOUSE. Thank you.

And our next witness is Ms. Kathleen Hartnett White.

STATEMENT OF KATHLEEN HARTNETT WHITE, DISTINGUISHED SENIOR FELLOW-IN-RESIDENCE AND DIRECTOR, ARMSTRONG CENTER FOR ENERGY AND THE ENVIRONMENT, TEXAS PUBLIC POLICY FOUNDATION

Ms. WHITE. Thank you, Senator Whitehouse, and thank you, Ranking Member Vitter, for the opportunity to testify before this committee.

I am particularly grateful to share my perspective as a former State environmental regulator of the Texas Commission on Environmental Quality, which according to EPA is the second largest environmental agency in the world. And before I address specific components of the President's climate action plan, I would like to note several very positive trends, and this is one of two graphs in my written testimony. According to the EIA, energy-related emissions of carbon dioxide decreased 3.7 percent in 2012, the lowest emission level since 1994. And as the graph depicts, as a measure of the amount of CO_2 generated per dollar of economic output, carbon intensity, a metric that EIA uses, the U.S. economy has been steadily less carbon intense since 1949. And in 1 year, 2012, that carbon intensity declined 6.5 percent.

And while part of that is a weaker economy than in previous decades and increased use of natural gas, I think it is really a remarkable trend, and I would credit it to the inherent efficiency in private markets that is always driving the business.

The President's climate action plan, I counted a mixture of at least 50 Federal programs or initiatives that most exist already. So many of them are reinforcing what already exists. Several components of which I think are quite alarming, particularly without congressional approval of such bold, bold projects. My overall assessment would be that in general a plan of that scope and inevitable cost that really deals with a policy of major national consequence must be, must be something that our voice in the U.S. Congress approves and is not merely a result of executive action.

I will turn the rest of my comments to the carbon pollution standards, the so-called new source performance standards that EPA, one of which is already proposed for the second time, and for new coal-fired power plants, the second of which is well underway as a plan, and from the standpoint, again, of spending 6 years implementing Federal law in air quality permits in Texas. It is from that basis and quite a bit of familiarity with how new source performance standards operate.

These new source performance standards are unquestionably the most aggressive action taken under the endangerment finding that CO_2 endangers human health and welfare. And they are the first direct regulation of carbon dioxide. I could give examples of previous indirect means but not time.

EPA uses, as has been mentioned by several today, carbon capture and control technology as the basis for which to craft the numeric limit. In my judgment, that standard is unquestionably infeasible for coal-fired power plants to attain, because carbon capture and control technology is not at all commercially demonstrated. This is really an unprecedented expansion of EPA's authority, because the net effect is to force fuel switching from coal to natural gas or from any fossil fuel generation to non-emitting generation such as renewables. I find nothing in the Clean Air Act that can authorize EPA to engage in what becomes really centralized energy planning.

To me, the Clean Air Act, which is a wonderful law, enshrines economic freedom, which is at the basis of this democracy. It allows private actors, not the EPA, to choose energy source, process and product. EPA, as has been repeatedly mentioned today, EPA's authority is limited to requiring best pollution control technology that has been commercially demonstrated for the industrial process in question. There is not one single successfully operating power plant in the United States for any length of time that has used CCS. There have been a number of pilot projects, they either failed or are incomplete. The EPA lays weight on the Southern Company's project in Kemper County, Mississippi, which is under construction and just was forced to acknowledge that its cost overruns went from something like $2.3 billion to over $4 billion.

Coal remains the largest source and the central mainstay of baseload electricity in this country. The infrastructure surrounding it has evolved over a century. And the coal industry has spent, in the last probably 10 years, an estimated $100 billion to install all kinds of elaborate pollution control technology to reduce by many, many times emissions of traditional pollutants.

And the pain, I think, is already occurring in this country and others. I see my time is about to run out, but I hope the U.S. Congress and EPA will look very, very carefully at what is going on in the European Union and countries that have made a rush to renewables. Der Spiegel reports in Germany, mainstream media, over 600,000 to 700,000 families in Germany are now cut off from electricity. Another headline in the U.K. was something to the effect, as referenced in my testimony, 24,000 elderly individuals in the U.K. may die this winter because they no longer have access to heat.

Thank you.

[The prepared statement of Ms. White follows:]

Review of the President's Climate Action Plan

Testimony
Before the

Committee on Environment and Public Works
U.S. Senate

Washington, D.C.
January 16, 2014

By

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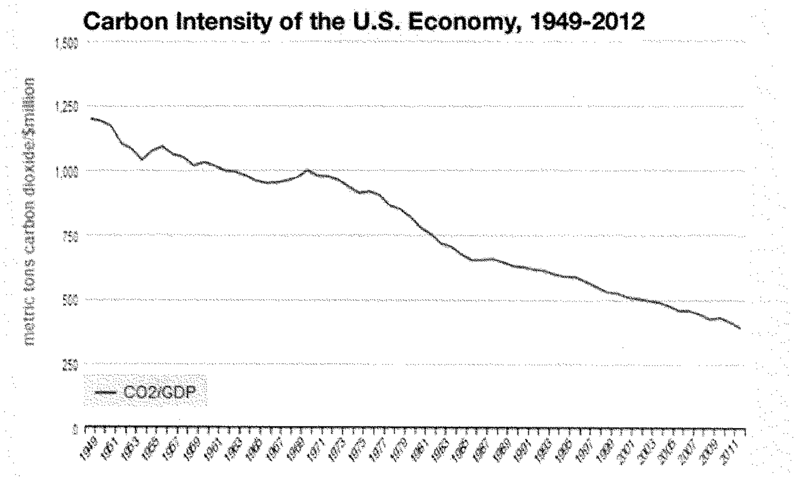
(2001-2007)

Introduction

Thank you, Chairman Boxer, Ranking Member Vitter, and fellow members of this committee for the privilege of testifying before the U.S. Senate's Environment and Public Works Committee. I am particularly grateful to offer my perspective as the former head of the state agency known as the Texas Commission of Environmental Quality (TCEQ), the second largest environmental agency in the world after the U.S. EPA.

The overwhelming majority of TCEQ's work is the actual implementation and enforcement of federal environmental regulation. Implementation of federal regulation in a state agency allows close observation of the actual -not estimated- impacts and relative effectiveness of federal policies in the towns, businesses, families and individual lives across Texas.



Source: EIA.

Powerfully Positive Trends

Before addressing specific components of the President's Climate Action Plan (CAP), I note the remarkably positive trends in U.S. emissions of anthropogenic carbon dioxide (CO2). In October 2013, the Energy Information Administration (EIA) announced that energy-related emissions of CO2 decreased 3.7 percent in 2012, the lowest emission level of CO2 since 1994.[1] And as a measure of the amount of

CO2 generated per dollar of economic output, the carbon intensity of the U.S. economy has steadily fallen since 1949. According to EIA, this carbon intensity declined 6.5 percent in 2012.[2]

Indeed, CO2 emissions in the U.S. are falling faster than in countries operating under mandates such as the European Union's Emissions Trading System or in countries like Germany which have most aggressively pursued renewable energy. Even before implementation of EPA's greenhouse gas regulations, U.S. CO2 emissions in 2012 fell 3.7 percent while Europe's declined by only 1.8 percent.[3] Although our weak economy and increased use of natural gas may have contributed to declining CO2 emissions, the long term trend is more the result of the private market's innate drive for efficiency.

The President's Climate Action Plan: Overview

The President's Climate Action Plan (CAP) is a mixture of at least fifty federal programs or initiatives that are mostly redundant at best. A few of the Plan's components, however, could be extremely damaging to the economy, low income families and even to U.S. national sovereignty. The Plan strikes me more as a legislative wish-list than an executive directive. Given the broad scope, cost, questionable need and lack of clear legislative foundation, such an expansion of federal purview is more properly the prerogative of Congress rather than the Executive branch.

The Plan's goal to reduce emissions of CO2 by 17 percent in 2030 appears arbitrary and without legislative foundation or technical justification. And the Plan seems out of sinc with significant developments in climate science as well as with NOAA's, NASA's , the UK's Meteorological Office, and even the IPCC's recent Fifth Assessment Report conclusions that recent extreme weather is neither historically unprecedented nor a result of man-made emissions of CO2.

EPA's New Source Performance Standards for CO2 from Electric Generating Units

The most aggressive provision in the Climate Action Plan directs the EPA to develop national regulatory standards for CO2 emission from power plants. EPA is already well underway on this initiative. The Agency recently re-proposed New Source Performance Standards (NSPS) for CO2 from new power plants and is developing a proposed NSPS for all existing plants. Based on carbon capture, control and storage technology, the CO2 limits dictated in EPA's proposed CO2 NSPS for new plants (or discussed for existing plants) are infeasible for coal.

In requiring the impossible, EPA breeches the limits of its regulatory authority under the Clean Air Act (CAA). Section 111(a)(1) of the CAA limits EPA's authority to technological-based limits achievable through "the best system of [emission] reduction" which has been commercially demonstrated. The only control measures now commercially available to reduce CO2 from coal fired generation are likely site-specific energy efficiency measures to improve heat rate. Energy efficiency is the indirect means of CO2 reduction that EPA utilized in its first greenhouse gas regulation for stationary sources- the so-called Tailoring rule applicable to large industrial sources.

EPA, however, now concludes that CCS technology does meet the CAA's required "best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated."[4] Carbon capture and storage technologies, however, have not yet been commercially demonstrated in a single successfully operating power plant. Several heavily subsidized pilot projects have failed and the few remaining, such as Southern Company's Kemper County project, remain incomplete with staggering cost overruns. Southern Company's – still under construction- project sees costs rising to$ 4.2 billion from an originally estimated $2.4 billion.[5]

Significant technical, financial, and regulatory barriers must be resolved before CCS can become a practicable option for significantly reducing CO2 emissions from coal-fired generation at a commercial scale. Parasitic load remains a key obstacle. When capturing carbon alone requires one-third to one-half of the electric power generated in the plant, the commercial enterprise is not viable.

Yet, EPA has remarkably declared that CCS is a feasible control option at a reasonable cost for coal generation. EPA, evidently, decided to conflate technical feasibility with adequate commercial demonstration. And analogizing CCS to the successful emission control technologies for conventional pollutants, such as flue gas-desulfurization (FGD) to reduce sulfur dioxide, does not apply. Compared with CCS, evidence for the commercial availability of FGD was substantial when EPA first required that control method in 1971.

The volume of CO2 that must be captured and stored is vastly larger than the volumes involved with the conventional pollutants regulated under the CAA. CO2 is measured in tons while the criteria pollutants are measured in parts per million. In volume and chemical properties, CO2 is wholly unlike conventional pollutants. The separating technologies long used for processing natural gas and chemicals pose none of the technical barriers of pre or post-combustion "capture" of CO2.

The net effect of EPA's NSPS for CO2 emissions from power plants is to force fuel-switching from coal to natural gas or from any fossil fuel generation to non-emitting generation (e.g. wind or solar). EPA concludes that few, if any, coal-fired power plants will be built in the next decade and so claims the NSPS for CO2 merely reinforces the market's trend toward natural gas and renewables. From this perspective EPA contends the proposed NSPS for new plants will not yield meaningful benefits or costs.

In a five-hundred page regulatory impact analysis, the Agency finds "under a wide range of future electricity market conditions, the proposed EGU GHG NSPA is not expected to change GHG emissions from newly constructed EGUs and is anticipated to impose negligible costs, economic impacts or energy impacts on the EGU sector or society."[6] Does EPA mean banning new coal-fired power plants will not reduce CO2 emissions in the future or increase costs because EPA's rule eliminates any uncertainty about the role of coal in future electric generation? Yet, EPA's mission, as stipulated in the CAA, does not extend to exercising federal power to force fuel switching or to "reinforce" trends that environmental regulators observe in the energy market.

EPA is no longer acting within its statutory authority to protect human health and the environment when the Agency arrogates the right to dictate the nation's energy infrastructure. This is a major expansion of the EPA's authority and violates a core tenet of the CAA. Under the statute, EPA cannot engineer the nation's energy infrastructure. Nothing in the Act empowered the EPA to engage in centralized energy planning and to command the specific means of energy production.

Regulatory decisions carrying the force of law with this magnitude of national consequence are unquestionably the purview of the U.S. Congress and not the Executive branch. Enacted and largely upheld over forty years the CAA enshrines an assumption of economic freedom in this democracy. The

CAA allows private actors- not the EPA- to choose energy source, process and product. EPA's authority is limited to requiring the best pollution control technology that has been commercially demonstrated for the industrial process in question. Mandating a technology achievable for natural gas and infeasible for coal puts EPA in the driver's seat of this nation's energy economy. An alarming precedent, EPA's proposed standards for CO2 turns the generation of electricity from an enterprise focused on productivity, efficiency and innovation into an industry that first and last must serve the government's purpose regardless cost or productivity.

The proposed CO2 New Source Performance Standards for power plants are EPA's first direct regulation of CO2 under a national numeric limit. EPA's initial CO2 regulations promulgated in 2010, such as the Tailoring Rule for the large stationary industrial sources, require CO2 reduction indirectly by means of Best Available Control Technology (BACT) derived energy efficiency measures. In great contrast, EPA's NSPS for CO2 requires an amount of CO2 reduction that is practicably infeasible. In so acting, EPA exceeds a fundamental limit to its authority imposed by the terms of the CAA.

EPA's increasing stack of mandates to reduce CO2 demonstrate why the federal Clean Air is wholly unsuited to regulate this most ubiquitous by-product of human activity and natural process. Whether labeled a "dirty pollutant" or not, this chemical compound remains "the gas of life" on this planet and thus is quite unlike the conventional pollutants Congress directed EPA to control in the CAA. CO2 is what results after combustion of a fuel and cannot be readily scrubbed, stripped, filtered or chemically changed but must be captured.

Also in contrast to genuine pollutants listed in the Clean Air Act, CO2 levels in our ambient atmosphere have no direct adverse health effects. EPA's Endangerment Finding that CO2 (and other greenhouse gases) endanger human health relies upon prediction of harm as a result of warmer temperatures in the future. OSHA sets a health effects level for CO2 at 5000 parts per million; current atmospheric levels of CO2 are approximately 400 parts per million.[7] In public communications, EPA increasingly regards CO2 as a pollutant no different from the six criteria pollutants listed in the Clean Air Act. This misinforms the public about the chemical and physical dynamics of human, animal and plant life on this planet.

The economic damage from EPA's multiple efforts to supplant coal already are felt across this country. More than two hundred power plants and rising number of coal mines have shuttered or plan closure as a result of the many new EPA rules for traditional pollutants or in anticipation of these NSPS for CO2. Unemployment in towns around these plants and mines rises. These closures also come on the heels of the coal industry's approximately $100 billion in investment in state of the art emission control technologies. Many coal plants already have reduced criteria pollutants and key toxins by 60-80 percent.[8]

Supplanting coal-fired generation is not toying with the margins of the electric power supply in this country. Coal remains the largest source and an essential mainstay of base load electric power operating at a steady state twenty-four hours a day. Historically less subject to volatile swings in price, coal is still critical to assuring reliable, affordable power. Energy infrastructure such as transmission lines and transfer stations developed over a century cannot be rapidly replaced without enormous loss in investment, supply, reliability, and affordability.

U.S. policy makers might consider the human pain created by the most aggressive regulatory initiatives in the history of EPA - energy poverty increasing in European countries and emerging in the U.S. The

EPA's rules already have hurt middle and low income families in our country. In the last ten years, the cost of energy as percentage of pre-tax income has nearly doubled for the poorest household and can absorb 40 percent of income.[9]

Generic "green energy" policies are now imbedded across the entire federal edifice, most of which without underlying legislation. And the impacts of those policies disproportionately hurt the poor. Even our Native Americans communities are denied the opportunity to develop their significant energy resources on tribal lands. Last October, the Wall Street Journal reported how federal energy policies obstruct tribal plans to use their energy assets to alleviate poverty and unemployment. Recall that the average incomes of Native American are about one-third that of U.S. citizens and their unemployment rates are four times the national average.[10] Is there not a more pressing moral obligation to allow Native Americans the fruits of employment and economic growth than to deny that opportunity in vague hope of averting a slightly warmer climate?

The Crow Indian reservation in Montana occupies one of the largest reserves of coal in this country. The tribe does generate considerable revenue from coal but federal agencies prevent fully taking advantage of their substantial coal assets. Tribal chairman Darrin Old Coyote put it simply. "The war on coal is a war on our families and our children."[11]

A Rush to Renewables: A Note of Caution

The federal government already has spent hundreds of billions of taxpayer's money towards aggressive deployment of renewable energy. Perhaps now is the moment to cease the lavish subsidies for more and more wind and solar installations- as envisioned in the Climate Action Plan - to allow time to integrate the new renewable capacity into the electric grids without sacrificing reliability and affordability.

At an installed capacity of 12,214 MW, Texas has more wind generation capacity than most countries. And Texas has just completed over 2000 miles of transmission lines to utilize the wind generated in the far westerns regions of the state - hundreds of miles from the population centers surrounding Interstate 35 running through the central Texas region. The $7 billion cost of those transmission lines – called the Competitive Renewable Enterprise Zones (CREZ)- will be paid by retail electric customers.[12]

How Texas will best utilize all this wind capacity remains to be seen. Because of intermittency and seasonal variability, the Texas grid (Electric Reliability Council of Texas) rates wind generation only at 8.7 percent of wind's installed capacity.[13] Increasing use of wind generation can increase reliability risks as the wind abruptly stalls or rapidly increases beyond wind speeds appropriate for generation. If wind generation receives dispatch priority, our state's highly competitive real-time nodal market will lose its competitive dynamic.

The soaring electric prices in European countries with ambitious renewable programs should give pause. Germany's rush to renewables has led to the highest electric prices in any developed country. Coupled with energy surcharges, taxes and fees, household energy costs have doubled since 2000. Germany has adopted the most audacious renewable initiative with a goal of 35 percent of electric generation from renewables by 2020 and 85 percent by 2050.[14]

Britain, Denmark, and Spain also rushed to renewables - and their energy consumers have suffered for it - but Germany tops the list for energy cost and human loss. Major media in Germany report increasing energy poverty – where heat energy is viewed as a "luxury good" in competition with food.[15] This was the human condition for the majority of the population 250 years ago before the Industrial Revolution when England first tapped the vast store of energy in coal.[16] For the first time since the Industrial Revolution, energy regression- as a policy choice in the most developed and affluent nations of the world, rears its head.

Germany began its "Energy Revolution" (Energiewende) in 2000 and dramatically accelerated renewable installations in 2011 after the Fukushima nuclear disaster in Japan. Since 2000, Germany's electric prices have increased 50 percent and are now three times higher than average U.S. prices. By 2020, German officials now conservatively estimate electric prices at 40 percent more than current prices.[17]

Der Spiegel reports that over 600-700,000 German households are cut off from electricity because residents could not pay their continually increasing energy bills. The Catholic charity, Caritas, takes energy saving light bulbs on their home visits and notes families must decide between using a light bulb or having a hot meal.[18] Has Germany's ambitious deployment of renewables reduced CO2 emissions? No, quite the contrary. Germany's CO2 emissions associated with electric generation have increased as more coal has been used to back up inherently intermittent and thus unreliable wind or solar electric generation – a problem that increases in frequency the larger the load renewables are called upon to play.[19]

As anecdotal evidence about energy regression, consider that trees in the U.S. are now felled and turned into wood pellets to be exported to Germany and Britain for home heating, cooking fuel and (not-so-low-carbon) electric generation. While in principle renewable, wood when burned emits abundant CO2 and particulate matter (otherwise known as harmful pollution). Let's hope U.S. energy policies do not lead to headlines reporting that "Rising Energy Costs Drive Up Forest Thievery," as more and more people revert to burning wood for heat.[20]

Likewise, Britain- the cradle of the Industrial Revolution that released entire populations from abject poverty- recently announced that one in four households now live in energy poverty. The Daily Mail warns of the risks of 24,000 deaths of the elderly this winter who cannot afford to heat their homes.[21]

That such a regression from modern living standards could occur so rapidly in these highly developed economies is a stunning turn of events that U.S. policy makers would be wise to absorb. Haphazard wishful- thinking policies that dismiss energy physics and transfer the cost to consumers are regressive and morally objectionable.

The Enigma: Fossil Fuel Is the Energy of Choice

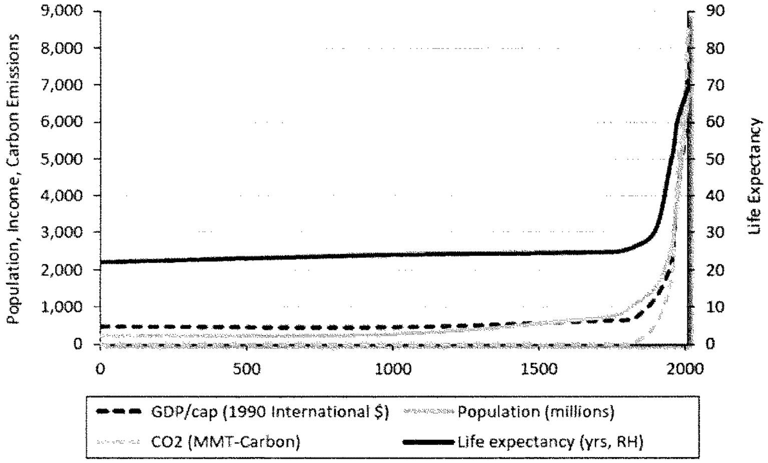
Energy dense, abundant, imperishable, versatile, reliable, portable and affordable, fossil fuels provide 85 percent of the world's energy because they are superior to current alternatives. This nation's prosperity – literally "powered" aided by the productivity made possible by concentrated energy- catalyzed multiple emission control technologies that have dramatically reduced the CAA's criteria pollutants and key toxins – genuine pollutants that can harm human health.[22] Fossil fuels have also reduced the human footprint on natural ecosystems. Fertilizer derived from natural gas has dramatically increased agricultural productivity as had the slightly increasing levels of atmospheric CO2.[23] Although wind, solar and biofuels have increased their share of the U.S. energy supply, they remain an inferior sliver of total supply. The EIA's Energy Outlook 2014 projects that fossil fuels will supply at least 80 percent of this nation's energy in 2040.[24]

Not so long ago, man methodically harnessed the dense energy in fossil fuels and so unleashed economic productivity on a scale never imagined in human history. When innovative minds like James Watt developed a steam engine which could convert heat energy into mechanical energy, the energy/economic limits under which all human societies had previously existed were blown apart. The greatest change was for the average worker. A life of back-breaking drudgery was no longer the common lot of the overwhelming majority of mankind.[25]

Population, life expectancy, and income per capita had changed little for all human history until the Industrial Revolution around 1800. Since then life expectancy has tripled and average global income per capita has increased 11-fold. Not coincidentally, man-made emissions of CO2 also have risen over the same period. See graph.[26]

Until energy sources comparable or superior to fossil fuels are fully available, grand plans to reduce CO2 emissions should proceed with caution, lest they prematurely jettison the wellsprings of mankind's greatest advance. The historic energy boom in the U.S., if allowed to flourish, offers the opportunity to lift millions out of poverty in this country and around the world. This country's energy riches can now be developed subject to elaborate environmental controls and without extending the human energy footprint on large swaths of still majestic natural ecosystems.

Figure 1
Global Progress, 1 A.D.–2009 A.D. (as indicated by trends in world population, gross domestic product per capita, life expectancy, and carbon dioxide [CO_2] emissions from fossil fuels)



Source: Indur M. Goklany, "Humanity Unbound: How Fossil Fuels Saved Humanity from Nature and Nature from Humanity," Cato, December 20, 2012; based on Angus Maddison, Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD, University of Groningen, 2010, http://www.ggdc.net/MADDISON/Historical_Statistics/vertical-file_02_2010.xls; World Bank, World Development Indicators 2011, http://databank.worldbank.org/; T.A. Boden, G. Marland, and R.J. Andres, Global Regional, and National Fossil-Fuel CO2 Emissions, http://cdiac.ornl.gov/trends/emis/overview_2008.html.

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[1] "Global Carbon emissions set to reach record 36 billion tonnes in 2013," Phys.org, November 18, 2013.
[2] Tom Randal, "America is Winning a Race That It Never Signed Up For," Bloomberg, November 4, 2013.
[3] *See supra*, note 1.
[4] Clean Air Act § 111(a)(1), 42 USCA § 7411(a)(1) (2006).
[5] "Southern Co replaces executives in wake of Kemper cost overrun," Reuters, May 20, 2013.
[6] Regulatory Impact Analysis for the Proposed Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, Environmental Protection Agency, September, 2013.
[7] "Chemical Sampling Information: Carbon Dioxide," United States Department of Labor, available at https:www.osha.gov/dts/chemicalsampling/data/CH_225400.html.

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[8] Tom Hewson & Benjamin Stravinsky, "Coal Fired Power Invested in Air Pollution Controls," Energy Ventures Analysis, May 3, 2009; "The Facts About Air Quality and Coal-Fired Power Plants," Institute for Energy Research, June 3, 2009.

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[10] Terry L. Anderson & Shawn Regan, "The War on Coal is Punishing Indian Country," Wall Street Journal, October 11, 2013.

[11] Ibid.

[12] Laylan Copelin, "Little fanfare for state's $7 billion clean-energy project," Austin American Statesman, November 2, 2013.

[13] Emily Pickrell, "Role of Texas Wind Power Debates After Winter Emergency," Fuel Fix, January 8, 2014.

[14] "Germany's New Energy Policy," Federal Ministry of Economics and Technology, April 2012; David J. Unger, "German voters follow Merkel down bumpy path to clean energy," Christian Science Monitor, September 23, 2013.

[15] "How Electricity Became a Luxury Good," Der Spiegel, September 4, 2013.

[16] Indur M. Goklany, "Humanity Unbound: How Fossil Fuels Saved Humanity from Nature and Nature from Humanity," Cato, December 20, 2012; see also Indur M. Goklany, "The Improving State of the World," Cato (2007); Matt Ridley, "The Rational Optimist," Harper Collins (2010); Edward Wrigley, "Energy and the Industrial Revolution," Cambridge University Press (2010); Julian Simon, "The Ultimate Resource 2," Princeton University Press (1996); George Gilder, "Knowledge and Power," Regnery (2013).

[17] Der Spiegel, supra, note 15.

[18] Ibid.

[19] Unger, supra, note 14.

[20] Renuka Rayasam, "Rising Energy Costs Drive Up Forest Thievery," Der Spiegel, January 17, 2013.

[21] Jenny Hope, "Fuel poverty in Britain: 24,000 will die from cold this winter and 6m fear they cannot heat their home," Daily Mail, October 27, 2013; see also Enza Ferreri, "Green Britain: Energy Blackouts Imminent," FrontPage Magazine, October 14, 2013.

[22] Kathleen Harnett White, "EPA's Approaching Regulatory Avalanche," Texas Public Policy Foundation, February 2012.

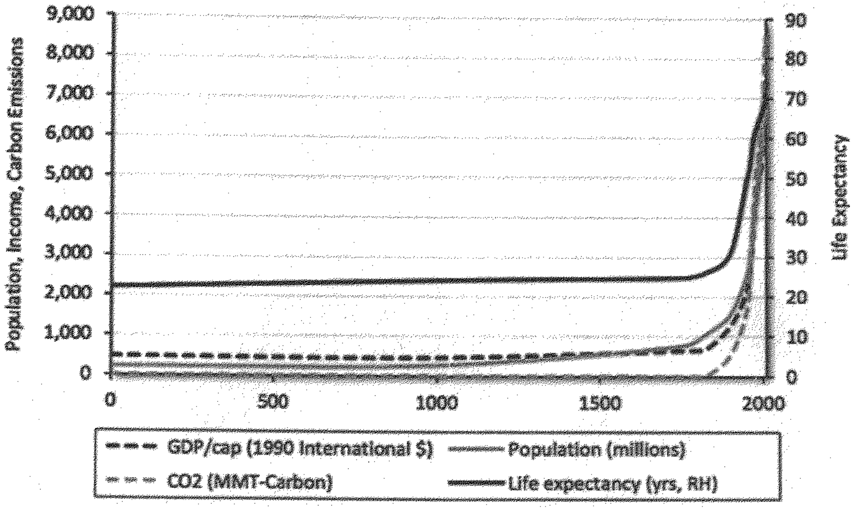
[23] Goklany, supra, note 16.

[24] "Annual Energy Outlook 2014 Early Release," Energy Information Administration, December 2013.

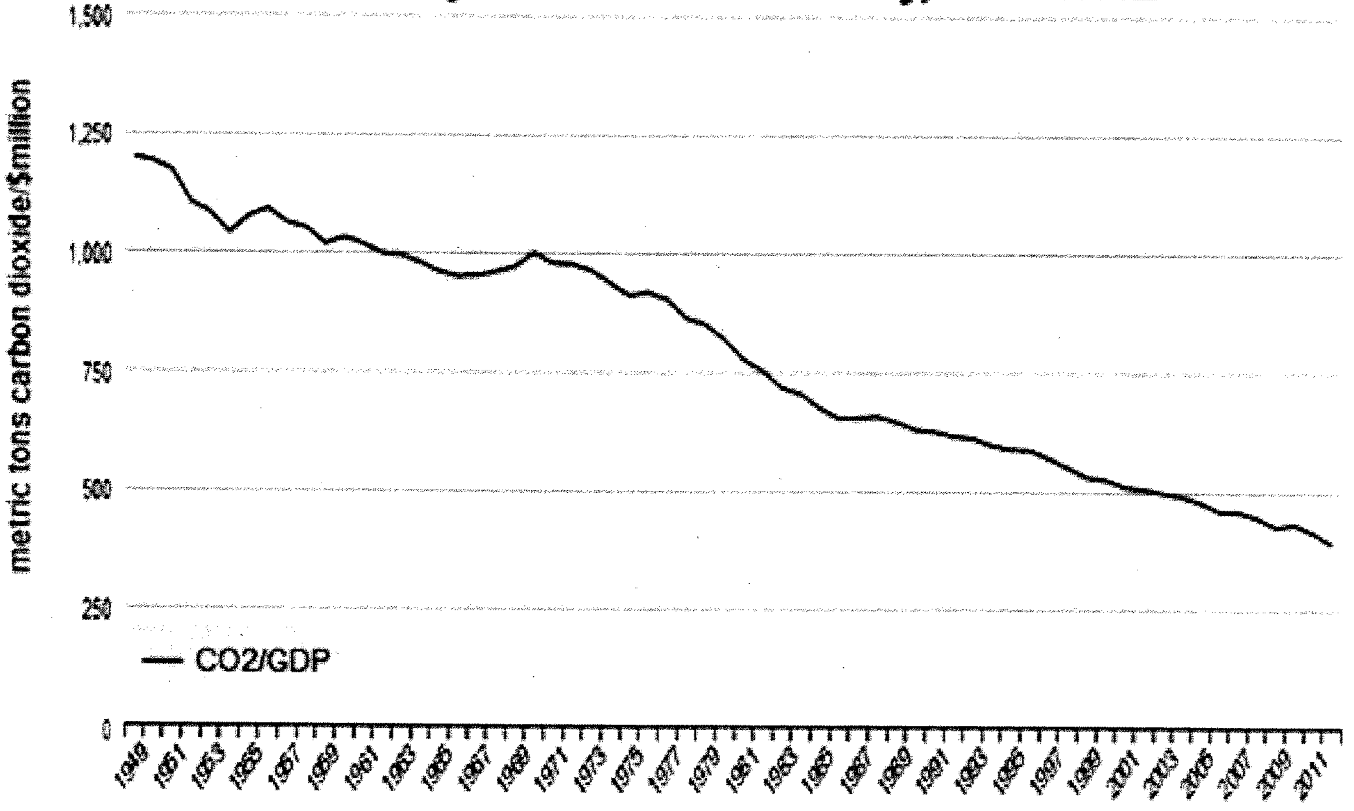
[25] Gregory Clark, "A Farewell to Alms: A Brief Economic History of the World," Princeton University Press (2009).

[26] Goklany, supra, note 16.

Figure 1
Global Progress, 1 A.D.–2009 A.D. (as indicated by trends in world population, gross domestic product per capita, life expectancy, and carbon dioxide [CO_2] emissions from fossil fuels)



Sources: Updated from Indur Goklany, "Have Increases in Population, Affluence and Technology Worsened Human and Environmental Well-being?" *Electronic Journal of Sustainable Development* 1, no. 3 (2009); based on Angus Maddison, *Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD*, University of Groningen, 2010, http://www.ggdc.net/MADDISON/Historical_Statistics/vertical-file_02-2010.xls; World Bank, *World Development Indicators 2011*, http://databank.worldbank.org/; T.A. Boden, G. Marland, and R. J. Andres, *Global, Regional, and National Fossil-Fuel CO_2 Emissions*, http://cdiac.ornl.gov/trends/emis/overview_2008.html.
Notes: Data are sporadic until 1960. This figure assumes that trends between adjacent data points are linear.



Carbon Intensity of the U.S. Economy, 1949-2012

U.S. Senate
Committee on Environment and Public Works
Hearing Questions on the Record
from Senator Jeff Sessions
to Kathleen Hartnett White

Question 1. On November 14, 2012, President Obama stated that "the temperature around the globe is increasing faster than was predicted even 10 years ago." Again, on May 29, 2013, the President stated that: We also know that the climate is warming faster than anybody anticipated five or 10 years ago." But the actual temperature data shows that this is not correct. Do you believe the President was correct when making these specific assertions?

Response. The President's assertions that global temperatures are increasing more rapidly than earlier predicted are incorrect. His claims of increasing global warming directly contradict the temperature trends observed by the five global temperature data sets used across the world and by the IPCC. *Since 1997 or 1998, these data sets show no statistically significant warming. .*

These data sets are measured by sophisticated satellites and an elaborate system of more than 400 terrestrial thermometers. The IPCC's most recent Fifth Assessment Report, issued in late September 2013, also acknowledges, but does not explain, this lull in warming predicted by the models comprising the substance of IPCC science over the last three decades.

The five temperature data sets include two remote sensing satellites (RSS): one operated by the Hadley Center (HadCRUT4) at the University of East Anglia in the UK and the other operated by the University of Alabama (UOA). The three terrestrial or land-based data sets are operated by the Hadley Center in the UK, NASA's Goddard Institute for Space Studies and NOAA's National Climatic Data Center. Upon inquiry, it appears that none of these data sets of recent temperature can provide any basis for the President's assertion about accelerated warming. Whether pulled from thin air or based on a localized data set of temperatures not representative of a global mean, the President's Science Advisor, John Holdren, should be questioned about this claim.

The remote sensing satellites are widely viewed as the most accurate measurement of temperatures. These satellites use platinum resistance thermometers which measure temperature at various altitudes above the surface of the earth. Terrestrial data sets are subject to various flaws including non-representative placement in urban areas subject to a heat-island effect.

The most recent numbers from the RSS operated by Hadley Center shows no warming for the last 17 years and 6 months- a total of 210 months. As noted by Dr. Judith Curry in her testimony on January 16, 2014 in the U.S. Senate EPW Committee, the growing discrepancies between observational measurement and the predictions of IPPC's climate models weaken the IPCC's case for concluding that anthropogenic emissions of greenhouse gases dominate the natural forces of climate such as the sun, water vapor and clouds. Observational evidence trumps modeled predictions. Assumptions about the natural forces' climate sensitivity to emissions of CO2 resulting from human activity is the core tenet of the IPCC science.

Question 2. In October, we released a report with the Environment and Public Works Committee Republicans entitled, "Neglecting Cornerstone Principle of the Clean Air Act: President Obama's EPA Leaves States Behind." The report chronicles EPA's increasing departure from the cooperative federalism approach established in the Clean Air Act. As a former head of the Texas Commission on Environmental Quality, you are probably familiar with EPA's obligation under our federal environmental laws to work cooperatively with States. When it comes to EPA's implementation of the President's climate agenda, is it your opinion that EPA is abiding by the "cooperative federalism" design of the Clean Air Act.

Response
Background Information
I request to supplement my answer to Question 2 with four papers (attached above) that I have previously written about EPA's disregard of the cooperative federalism fundamental to the basic constitutional and administrative structure of the federal Clean Air Act (CAA).

These papers are:
"The Clean Air Act: The Case for Reform," Texas Public Policy Foundation, November 2012.
"The Clean Air Act: Reform Proposals," Texas Public Policy Foundation, October 2012.
"EPA Process vs. Texas Results," Texas Public Policy Foundation, September 2010.
"Texas' Ozone Success: Changing Standards Mask Texas' Ozone Achievements," Texas Public Policy Foundation, May 2010.

Response: I fully agree with the Environment and Public Works Committee minority report that the current EPA increasingly departs from the cooperative federalism imbedded in the CAA – a "cornerstone principle" of the Act. EPA began straying from this partnership between federal and state authorities outlined in the CAA after the 1977 amendments – and even more so after the 1990 amendments to the Act. The increased oversight authority given to EPA in these amendments has been used, at the worst, to usurp and, at the least, to micromanage the state authority built into the basic design of the original CAA.

Contending with the EPA's micro-management of the state's lawful role in the development of State Implementation Plans (SIPs) and permitting programs daily absorbed perhaps half of my time for six years when I served as Chairman of the Texas Commission of Environmental Quality from 2001-2007. Yet, when compared to EPA's aggressive denial of state authority under President Obama's administration, the earlier relation between EPA and TCEQ was ultimately more of a productive partnership -although with inherent but not insuperable tension.

The federal courts already have reversed some recent EPA actions on the basis of EPA denial of statutorily guaranteed state authority, but the damage from EPA's unlawful aggression already has been incurred. A court's vacature and remand rarely resolves the problem but just sends EPA back to the regulatory drawing board to try a similar approach again. Key reforms of the CAA are needed to specify the states' role and legally restrain EPA's continual encroachment on state authority.

The President's Climate Agenda and Cooperative Federalism

EPA's implementation of the President's climate agenda has run rough shod over the rudimentary state authority guaranteed under black-letter provisions of the CAA. EPA not only departs from any vestige of cooperative federalism but also treats the states more as regional offices of the federal Agency than a partner and sovereign state. EPA's forced march from the Endangerment Finding in December 2009 - through adoption of four related rules- to an automatically effective date of greenhouse gas regulation on January 2, 2011 is unprecedented. These rules include the Tailpipe Rule, the Timing Rule, the Tailoring Rule, and a Sip Call to 13 states.

In this imperial initiative to assert regulatory authority over carbon dioxide (CO2), EPA denied to states the fundamental due process reflected in the CAA and guaranteed in U.S. Constitution. In the Timing Rule, EPA omitted the notice and comment period, cleverly characterizing a seizure of vast regulatory authority not authorized by Congress as an interpretive rather than a substantive rule. Recall that this rule was the trigger for extending regulatory authority over a new universe of 6 million stationary sources by EPA's own admission. In the Timing Rule and the Tailoring Rule, EPA declined to estimate compliance costs or conduct a cost-benefit analysis.

Unprecedented Federal Implementation Plan (FIP) Imposed on Texas

Texas refused to comply with EPA's dictates to begin regulation of ghg in January 2, 2011 because the non-delegation doctrine in the Texas constitution prevents a state agency from automatically implementing new federal dictates without authorization from the state legislature or through a period of notice and comment to impacted entities and the general public. Under the CAA, states have at least 18 months to incorporate new federal requirements into their SIPs.

And how did EPA respond to Texas? EPA issued the first in its history, Interim Final Federal Implementation Plan (FIP) on Texas. A tortured legal concept intended for instances of imminent harm, this Interim Final FIP asserts immediate authority over the state's air permitting programs without a scintilla of due process.

EPA's Invalidation of Texas' Flexible Permitting Program

Although not part of the President's climate agenda, the EPA's invalidation of the Texas Flexible Permitting Program – in place for sixteen years – is an especially egregious example of the current EPA's cavalier disregard of states' authority to design-regulatory programs which implement and enforce federal air quality requirements.

In 2010, the EPA disapproved the Texas Flexible Permit Program. This state regulatory program was key to the air quality improvement in Texas over the last 16 years. An example of the dramatic improvement, the Houston region, in years past vying with Los Angeles as the most ozone polluted city in the country, reduced ozone levels from 119 parts per billion (ppb) in 1999 to 84 ppb in 2009. The home of the nation's largest petrochemical industrial chemical complex, Houston, Texas met the then legally binding 85 ppb ozone standard. In August of 2012, the Fifth Circuit Court of Appeals vacated EPA's disapproval of Flexible Permit Program, but the environmental and economic damage flowing from EPA's disapproval persist as do the lost opportunity costs for Texas business, TCEQ and air quality.

EPA's disapproval of Texas Flexible Permits unraveled the authorization of over 140 major facilities and demanded that those refineries, large power plants, chemical plants and factories get new federal authorization on threat of closure. In what was a dispute about rule language and "drafting style" was used by EPA to threaten closure of the major industrial facilities in Texas. Brandishing the coercive club of enforcement authority, EPA claimed to help the facilities by allowing them to sign an Enforcement Decree - not subject to negotiation- requiring an admission of violating federal law and payment for a community project, none of which is required federal law. Although the federal appeals court vacated EPA's disapproval of this innovative Texas program, in the time between EPA's disapproval in 2010 until the court's vacature of EPA's action in 2012, most of those 140 facilities had no choice but to "de-flex" their permits under EPA's dictates- losing the environmental and economic benefits of the original Flexible Permit.

The Texas Flexible Permit Program reflected the value of the cooperative federalism imbedded in the CAA. States' are best equipped to design implementation strategies that maximize environmental gain and minimize economic impact. State authority provides greater accountability. Local knowledge matters. The state is closer to the regulated entities and the communities in which they operate. State agency staff has hands-on knowledge of the regulated entities and a far more practical understanding of the real-world effects than distant EPA staff.

Recent federal court decisions that uphold the CAA's cooperative federalism are helpful. Given the increasing examples of EPA's disavowal of state authority, minor amendments to the CAA are necessary to solidify the distinction between federal and state authorities.

Senator WHITEHOUSE. Thank you very much, Ms. White.

I have the gavel, and so by definition I am going to be the last Senator in the room. So I will let my colleagues precede me in order to allow them to move on to their schedules.

I will begin with the ranking member, Senator Vitter, and then we will follow him with Senator Boozman and myself. So it looks like it is down to the three of us. Senator Vitter.

Senator VITTER. Thank you very much.

I want to get back to this push for us to talk in a fairly precise, disciplined way about the science and not be cartoonish about it. And certainly, folks in the Congress are a lot more guilty of that than anyone at the table. So I don't mean to level that criticism at you all.

Dr. Curry, you say "Claiming an overwhelming scientific justification for the plan," meaning this particular climate action plan, "does a disservice both to climate science and to the policy process." Why don't you expand on that a little bit more and explain what you mean?

Ms. CURRY. There is a great deal of research that needs to be done to better understand climate variability and change. Everything from the sun, climate connections, natural internal variation, the role of oceans and so on, there are a lot of things that we don't have adequate understanding to. And to think that all we need to do is leap to the impact assessment part of the problem I think does a disservice to the science, and we could end up with misleading conclusions if we don't really keep trying to understand these aspects of the climate system better.

Senator VITTER. One of my biggest pet peeves in this regard is the growth in the last 10 years of the mantra, the rallying cry of extreme weather. Because there are a few trends and there aren't a lot of trends. Certainly for obvious reasons, I am from Louisiana, I care a whole lot about hurricanes, and I have lived through way too many. But we had a hearing before this committee that dealt with, among other things, extreme weather. And it was the consensus of every witness, I don't think there was any disagreement, that in terms of historical record and observation, there is no observation, there is no historical record of increasing hurricane or tornado activity, both in terms of frequency and in terms of strength. I point to those two things, because those are the things that are most often talked about in terms of this extreme weather narrative.

Do any of you disagree with that in terms of the historical record, the metrics about hurricanes and tornadoes?

Ms. CURRY. I have testified twice previously on House committees related to hurricanes and climate change. There are in some regions observations of increasing intensity of hurricanes, in the Atlantic and the Indian Ocean since 1980. But there is absolutely no way to separate that out from anthropogenic causes versus natural climatic variability.

For example, the hurricanes in the Atlantic are probably as intense in recent decades as they were in the 1950s. So there is just no way to separate it out from natural versus anthropogenic, although in a few ocean basins there is evidence of increased intensity in hurricanes.

Senator VITTER. Does anybody else want to comment about that specific subject?

Mr. DESSLER. Yes, I mean, we do have evidence of precipitation, more intense events. Now, again, I don't know what the attribution science is on that. But we do see more rain falling and more intense events. We are seeing more extreme heat waves. In some cases, those have been attributed, at least partially, to anthropogenic effects. So in certain things we can do some attribution. But you are right, there is a lot of uncertainty in some of these.

But again, as I said in my testimony, I would encourage everyone to think about the things that we are certain about, instead of arguing about, well, we are uncertain. We are certain the temperature is going up. We are certain, or virtually certain, we can argue epistemological certainty and science. We are virtually certain that it is getting warmer, extreme heat events, the oceans are going to rise, the oceans are getting more acidic. These are certain, or virtually certain.

Senator VITTER. I accept your testimony. I was specifically asking though because this is what is bandied about, at least around here and in the media all the time, hurricanes and tornadoes. Do you disagree with the discussion we have had about hurricanes and tornadoes and that historical record?

Mr. DESSLER. No, I agree with what Dr. Curry said, and I agree there are a lot of foolish things that are said by a lot of people in the climate change debate on both sides of the debate. I think you are exactly right, we should really stick to the science and really see what the scientists say.

Senator VITTER. And Dr. Curry, going back to you, you made the statement with regard to this in general, "The sense that extreme weather events are now more frequent and intense is symptomatic of weather amnesia prior to 1970." Can you explain what you mean exactly?

Ms. CURRY. It is just that people remember back a decade or two. But if you look at the actual records, the data records, there was much more severe weather in the 1930s and the 1950s in the U.S. That is a matter, you can look at EPA, plots, I think I cited one in my testimony about heat waves, the heat wave index was much worse in the 1930s than anything we have seen in recent decades.

So almost all extreme events were probably, in the U.S., were worse in the 1930s and the 1950s. The one exception, which Dr. Dessler mentioned, was the 1-day extreme precipitation amounts. We see higher values of that since the 1990s.

Senator VITTER. Thank you all very much.

Senator WHITEHOUSE. Thank you, Senator Vitter. Senator Boozman.

Senator BOOZMAN. Thank you very much.

Dr. Dessler, I agree with you, the science is settled in regard to smoking. Would you agree that there was a time, though, that the science was such that most scientists felt like smoking was OK?

Mr. DESSLER. I am sorry, was there a time when they said smoking was OK?

Senator BOOZMAN. Yes, when the medical authorities felt like smoking wasn't a big deal and it was OK?

Mr. DESSLER. Yes, I think probably in the early 20th century.

Senator BOOZMAN. The point I am making is, the idea, and I think you agreed to it a few moments ago, in the sense that the idea when people question things and then all of a sudden their motives and that they are crazy in questioning the scientific aspect of the day, because most of the time whoever made it such, made the discovery did the research and started questioning, many times those people were held in poor standing.

So I don't think that is healthy, and I think you would agree with that, is that correct?

Mr. DESSLER. Yes, I think that free inquiry is one of the hallmarks of science.

Senator BOOZMAN. I think the question is, in the smoking example, you solve that problem by not smoking anymore. In this problem, we can't solve that problem by not having manmade CO_2. We are going to create manmade CO_2. So I think the question is, is the climate model science-settled, is the science settled as to how much people are producing, and is the science as to how much we can throttle back where we actually would have an impact, a measurable impact to reverse the process.

So do you feel like those areas are settled?

Mr. DESSLER. So, your question about how much CO_2 we produce, that is settled. We have a really good accounting of how much carbon dioxide comes from fossil fuel combustion, cement and deforestation. There is some uncertainty, we understand that.

Senator BOOZMAN. So when you add in all of the rest of the atmosphere, the solar aspect, the volcanoes, all of that, that is pretty well settled?

Mr. DESSLER. We have good measurements of the output of the sun for the last few decades. You have to measure it from satellite, and volcanoes, you can see it from space. So we have pretty good measurements of the radiative force that comes from those. So there are not big uncertainties in that.

There are some uncertainties in aerosols. But as carbon dioxide accumulates in the atmosphere, very soon it is going to be really the only game in town.

Now, as far as your question about can do we something about it, it is interesting because I think Dr. Curry and I agree completely, we just said it in a different way. I agree with her that we have no control, no fine control over the climate. I agree that no matter what we do, we probably won't see impacts for a decade or two or three. The climate of the next few decades is essentially already determined by other factors.

But the one thing we do have control over is, we have control over the climate in the second half of the century and in the century after that and for the next thousand years. So if we dial down, we will avoid the very large warmings that are predicted.

Senator BOOZMAN. So the science is settled as to how much you dial down that will produce this or that happening?

Mr. DESSLER. I would say that there is wide agreement on a range of climate sensitivities.

Senator BOOZMAN. But it is not settled, is it?

Mr. DESSLER. Well, it is settled, I would say it is settled on a range. And you know what I would encourage you to do is, don't take my word for it. I would invite you to go to a meeting of climate scientists. The AMS meeting is in 2 weeks in Atlanta. Dr. Curry will be there, I will be there. I talked to Marshall Shepherd, President of the AMS. He says you guys are more than welcome. Show up, talk to people. And you can find that most people would say there is a range of sensitivities.

Senator BOOZMAN. Let me ask, and then we will go back if he will allow, do you agree with that? Is the science settled?

Ms. CURRY. The significant thing, and this is in my written testimony, is that the range of sensitivity was, the likely range was 2 to 4.5 degrees Centigrade in the Fourth Assessment Report. The range has dropped to 1.5 to 4.5. So it was lowered as a result of a growing collection of empirically based, observationally based studies that indicate lower values of climate sensitivity at 2 degrees Centigrade or lower.

So, and for the first time, the Fifth Assessment Report declined to give a central number, whereas the Fourth Assessment Report said 3 degrees was sort of the central value. The Fifth Assessment Report gave no central value because this dichotomy of the low values from observations and the higher values from climate models. So I would say that sensitivity to doubling of carbon dioxide is now less certain than we thought it was at the time of the Fourth Assessment Report.

Mr. DESSLER. Could I add one thing to that? That is, of the First, Second and Third IPCC Reports did not give a central estimate and their estimate of climate sensitivity was one and a half to four and a half. Only the Fourth moved it up to 2 degrees and gave a central estimate.

And I agree, there is a range of evidence, you can argue about the range. But I would say that there is broad consensus, if you go to a scientific meeting, you talk to scientists, you will hear some say, yes, this is the range. There may be a few people who are outliers. But that is what it is. And given that sensitivity, you can then sort of project, OK, if we cut this much, this is the temperature.

Senator BOOZMAN. The thing that I would like to know, we had comments about what is going on in Europe and things like that. They are really backing up. India and China have both said that they are not going to participate, they want their 200 years of industrial revolution. So as I said earlier, all pain with no gain. At some point we need to be honest with the American public as to what we are doing, what the cost is going to be, and what the result is as far as actually making a difference if the modeling is correct and all that, all those things which we are currently using. I think there is some question as to that.

That is the only point I would make.

Mr. LASHOF. The point I was going to make is that the policy question is, do we know enough about the risks to take certain steps to reduce emissions of carbon dioxide. I think the answer to that is clearly yes. That doesn't mean we should do crazy things, but it means we should take sensible steps forward and China also believes that. China is actually looking at capping their own emissions in the near future, and they recognize that the pollution, both of conventional pollutants and of carbon dioxide, is a huge threat to their economy and well-being in the future. So it is really, in

China now, just a question of timing. But if you look at the U.S.——

Senator BOOZMAN. So the Chinese, they are not building coal-fired plants?

Mr. LASHOF. They are building coal plants, but they are also building wind, they are also building solar. The issue is, you look at the individual policies in the President's climate plan, do they make sense, I think the answer is clearly yes.

Senator WHITEHOUSE. For what it is worth, I just came back from China. I went there with Senator McCain. We met with the second highest ranking individual in the most important ministry in the Chinese government. And that is their climate minister. And in everything that we heard from him and everything that we heard from our embassy briefer as well, the Chinese are absolutely deadly serious about getting something done. They have to keep building coal plants for a while because their economy is growing so fast that they need the power, and they know that they can bring that online.

They also know that that is their biggest risk of social upheaval and disruption. Because people are so fed up with the environmental consequences that they are experiencing across that country, it is the No. 1 thing, our embassy told us, that frightens the Chinese government about a green revolution type of thing that could upend their rule.

As a result, they are investing very heavily for two reasons in new technologies. For instance, new nuclear technologies that are stalled here in the United States, developed here in the United States, they have decided to invest in them and they are planning to allow them to go forward, would allow them to actually burn spent nuclear fuel to create power.

They also want, in the nuclear industry, in the wind, solar, battery storage, all the array of new industries that are going to emerge to make for the clean energy economy, competitive advantage against us. So they have a mercantile reason for doing it and a self-preservation reason for doing it. But I cannot tell you how strong the sentiment was, both from the embassy and from the Chinese officials we visited, including their very highly placed climate minister, that they are deadly serious about fixing this, and that it is vitally important to them for a whole number of reasons.

Let me also just follow up with Governor Ritter. You opened your testimony with the phrase, you said bipartisan coalescing at the State level. Could you describe a little bit more of what you see as bipartisan coalescing at the State level and why you think bipartisan coalescing is happening at the State level while here in Congress this has become part of the culture wars and the deniers are forcing inaction?

Mr. RITTER. Thank you, Mr. Chairman. I won't hypothesize about what is happening here, but what I can tell you at the State level, you take a State like Ohio where there have been efforts to undo the renewable energy standard, or the energy efficiency resource standard that seems to fail because the business community is able to approach Republicans and Democrats alike, in the State house as well as approach Governors, and make the business case for a clean energy economy.

If you look at the supply chain for clean energy manufacturing in Ohio, it is a great example of a place where there has been an economic vitality to that State in part because of clean energy. The same is really true, I think the Governor of Michigan understands, first of all, they are importing all of their coal. They have abundant wind and natural gas and the ability to, and actually solar, the ability to really mix that over time, increase their renewable energy standard, increase their reliance upon natural gas, lower their emissions and help their economy.

There have been other States that have already been able to do that, and so some of these States are looking at the examples of other States. But at the State level where Governors actually have to compete every day with other States for economic vitality they don't just talk about it, you actually have to do it. In those States I think that have looked around, they understand, it doesn't matter if I am a Democrat or Republican, if I am not creating jobs in this State, and if I am not doing it in a way that also responds to environmental concerns or even climate concerns, then I may be out of a job.

Governor Brewer in Arizona is a big champion of solar. And she isn't a big champion of solar because she is Republican or Democrat, she happens to be a Republican, but because that economy is really going to rely heavily going forward on the solar industries, the variety of solar industries. In Colorado, where we made this big push around this aggressive renewable energy standard, even during the downturn, the one place in the private sector where our economy grew was in the clean energy, clean tech sector. So while it is still, while renewable energy is still a small part of the portfolio, certainly the natural gas or certainly the coal, I think we have seen the clean energy economies in States make an impact on those various State job creation abilities, the various economies.

Senator WHITEHOUSE. And very often that occurs with the strong support of major American corporations. Since Senator Boozman is here, I will read from the Wal-Mart 2009 Sustainability Report. Here is what Wal-Mart published. Climate change may not cause hurricanes but warmer ocean water can make them more powerful. Climate change may not cause rainfall but it can increase the frequency and severity of heavy flooding. Climate change may not cause droughts, but it can make droughts longer. Every company has a responsibility to reduce greenhouses gases as quickly as it can.

They continued by saying, that is why we are working in a number of areas to reduce our company's carbon footprint and also working with our suppliers and customers to help them do the same. Currently, we are investing in renewable energy, increasing energy efficiency in our buildings and trucks, working with suppliers to take carbon out of products and supporting legislation in the U.S. to reduce greenhouse gas emissions. Wal-Mart may be our biggest company. If we have a bigger, it is Exxon, which is really no longer an American company, it is an international creature.

Mr. RITTER. We have done a variety of things as well, Senator, with utilities. Utility CEOs and CFOs around the country understand as well their own sort of vulnerability, their own risks. They do their own corporate threat analysis. They have their own shareholders.

Senator WHITEHOUSE. A number of big American corporations have actually imposed an internal price on carbon.

Mr. RITTER. They have done an internal price on carbon. They also, like Wal-Mart, are going up the supply chain to look at consumer goods that come their way are produced and ask the question as it relates to greenhouse gas emissions.

I actually spent some time in Bentonville with the sustainability team at Wal-Mart for a National Academy of Sciences panel that I am participating in, and had what I would consider a brilliant day in listening to Wal-Mart's leadership discuss about their sustainability efforts around the country, and then thinking about how to do that as well with the supply chain. But it is a great example.

Senator WHITEHOUSE. Great. Thank you very much.

Ms. Curry, you are described very often when I look up your name as a contrarian climate scientist. What does that mean?

Ms. CURRY. I have no idea. There is a lot of words that get bandied about in the political debate.

Senator WHITEHOUSE. This is not just in the political debate. This is like Google, news stories, all sorts of things.

Ms. CURRY. Skepticism is one of the norms of science. The way that we test theories and ideas is to challenge them. And a good theory will be able to defend itself against challenges.

When people try to defend their theory by calling people who challenge their theory by names, deniers, whatever, that is not a good sign that it is a strong theory.

Senator WHITEHOUSE. Do you think the scientific theory is influenced by what a scientist is called?

Ms. CURRY. No. I am just saying this is part of the public debate, not the scientific debate.

Senator WHITEHOUSE. OK. I thought you were saying that you called into question the scientific theory what you were called.

Ms. CURRY. I don't know that Andrew would call me a contrarian.

Senator WHITEHOUSE. And that doesn't seem to be right.

Ms. CURRY. I don't think climate scientists would call me a contrarian.

Senator WHITEHOUSE. Is it true that in 2007 you wrote in the Washington Post about climate change that if the risk is great, then it may be worth acting against, even if the probability is small, and that you have yet to see any option that is worse than ignoring the risk of global warming and doing nothing? Was that your Washington Post editorial from 2007?

Ms. CURRY. Yes, I wrote those words in 2007. A couple of things. My thinking has evolved somewhat since 2007, as I have seen increasing evidence. I still think that there is a real risk there and that we need to figure out how to deal with it.

Senator WHITEHOUSE. You do think that there is a real risk there and that we need to figure out how to deal with it?

Ms. CURRY. Yes. We may decide to do nothing and just to do local adaptation and to see what happens.

Senator WHITEHOUSE. That would probably be the worst option, though. Correct?

Ms. CURRY. I am not judging specific policy options.

Senator WHITEHOUSE. OK. Well, as of 2007, you would have thought that was the worst option.

Ms. CURRY. Yes, as of 2007. I had more confidence in the consensus, the IPCC consensus, I had more confidence in that process.

Senator WHITEHOUSE. Let me turn to Ms. White for a moment.

You opened your testimony by saying that you brought good news. And the good news was that carbon emissions and carbon intensity were both declining.

Ms. WHITE. Yes.

Senator WHITEHOUSE. Why is that good news?

Ms. WHITE. It could be on a variety of levels, depending on the point of view. It is a measure of efficiency, energy efficiency in our economy. It is also a lot of the emission control technologies or methodologies for the traditional pollutants, the criteria pollutants listed in the Clean Air Act as well as toxins. The great efforts over the last 20 years that are in place now, those also just coincidentally reduce CO_2. So I think you see in those, you see the general reduction of any kind of——

Senator WHITEHOUSE. Any other reason that reducing carbon emissions is good news?

Ms. WHITE. I think the reasons I just stated were very good. It is a measure of reducing all those others. I defer not to something that someone calls consensus science. I have tried to follow the science, been involved with my work in environmental regulation for 30 years. But I do not reach a conclusion.

Senator WHITEHOUSE. So are the only two reasons that you think it is good news, that carbon emissions and carbon intensity are going because it shows that some emissions controls, technologies are working and the energy economy is becoming more efficient?

Ms. WHITE. I think that is profound, that the continual efficiency of our economy, even as population grows and the economy grows. I think that is something——

Senator WHITEHOUSE. In terms of the carbon emissions having any effect on, say, the atmosphere or our oceans? Do you think it is good news with respect to the atmosphere and oceans as well?

Ms. WHITE. Well, like I said, I don't reach conclusions on that. But because there are——

Senator WHITEHOUSE. Why would you not reach conclusions on that but reach conclusions on energy efficiency?

Ms. WHITE. Because I am not as persuaded by the science as I understand it as layman than some others.

Senator WHITEHOUSE. OK, so you are just a layman with respect to carbon's effect on the atmosphere?

Ms. WHITE. Yes, with respect to science. I am——

Senator WHITEHOUSE. OK, well, I will end that there.

Ms. WHITE. But if I could say one more thing, and this is that——

Senator WHITEHOUSE. And then I will turn back to Senator Boozman, who would like another moment.

Ms. WHITE. In response to Dr. Curry's testimony, I am struck that there is a very significant need for more research on natural variability and the climate sensitivity to manmade CO_2 in the context of natural, as you mentioned, in terms of aerosols and the sun and all of that. I think——

Senator WHITEHOUSE. Senator Boozman.

Senator BOOZMAN. The only thing I would say is that I think every company, every individual, all of us need to do a much better job of doing what we can, and we can, conservation I think is the key to this whole thing. We don't talk near enough about it. Back when most of you all were growing up, like me, you simply did not leave a room without turning out the lights or your parents yelled at you and said, turn the lights out. We don't do that anymore.

The other thing is, the question is, with a potential problem, I think the question is, are we better off with coming up with a complex scheme like the cap and trade program that was passed in the House, which was overwhelmingly rejected by the American public, and I think you could argue that it was one of the major drivers for the Democrats losing the House that year, are we in the position to micromanage this thing up here with very complex schemes as we have done with other things. I think that the States are doing a good job. You have alluded to that. Senator Whitehouse alluded to the fact that industry was getting aggressive.

And I do think that, I think Ms. Curry is very representative of the group of scientists who, in good faith, simply don't feel like the science is settled. I think there is evidence in that regard. Certainly the modeling, the fact that we can just say, this modeling is perfect and this and that, and we can predict all these things, I think that it is OK, we need people to question these things. It is very, very important.

The other thing is, if we are in a situation, and I think it is really up for grabs whether or not the Chinese or the Indians, the discussions I have had with them, they might be doing a better job. But the discussions I have had with them again, their attitude is, we will be responsible in 200 years after we have our industrial revolution. We have problems we have to deal with. And they might ratchet it down where they can actually see their hand in front of their face again, as opposed to now.

But what I want to know, from all of you at some point in time, and I don't think it is fair that the American people don't understand this, what is going to be the cost? What we have to do as a country, if nobody else really participates at great length, if we do all these things, what is going to be the end result? What is that going to do to our environment, what is it going to do to whatever.

There are certainly a lot of things that we can do and need to be doing, common sense things. We all want to protect the environment, and we can do a much better job of that. But when you really make it such that you are talking about significantly increasing electricity prices, what I want to know at some point is what is that going to do to jobs, what is it going to do to people who are retired on fixed incomes, what is it going to do to single moms, all of those kind of folks, when you are talking about significantly increasing their energy prices and their gasoline, electricity and things like that.

And if somebody would comment that you can do that without significantly increasing energy prices, I would like to hear that.

Mr. LASHOF. We did analyze a proposal for achieving significant further progress, building on the progress which I think is quite significant over the last 5 years. To continue to reduce the CO_2 emissions, particularly from the power sector, which is our biggest source. And we find that we can make another 23 to 30 percent reduction without a significant impact on electricity prices.

Why? Well, partly because of energy efficiency, we are learning to use electricity much more efficiently and we have a lot more potential there. It doesn't just happen by accident. The States have adopted policies that are driving an $8 billion industry in that.

The other reason is the cost of renewables has come down remarkably in the last 5 years. Wind is now much cheaper than building a new coal plant, and is competitive with just operating some plants in some circumstances. Solar has come down by 80 percent in the last 5 years. People haven't really fully understood the revolution that has happened in the renewable energy industry over that period of time. We actually have a huge opportunity to get big reductions without driving up electricity prices in a significant way.

Senator WHITEHOUSE. Let me thank the witnesses very much. Let me thank Senator Boozman for staying.

I would respond on that that there clearly are costs if you apply what I proposed, which is a carbon fee. But if you make it revenue neutral, then every single dollar of it goes back to the American public. And so net, net, there is no cost. What you get is savings in terms of not having to fortify our coasts, for instance, against rising sea levels, not having to figure out how you deal with fishermen whose catches have moved either offshore or out in the deeper waters or into other States that they can't reach any longer.

What do you do with foresters whose forests are burned because the pine beetle climbed up higher because there was no cold snap to wipe them out, and so there are the red forests that Senator Merkley described.

Then there is the competitiveness question which is that if we invest only in the fossil fuels, which are on the wrong end of the cost curve that Dr. Lashof described, solar and these technology based sources are going to continue to reduce, and fossil and extractive based are going to continue to be expensive. If we are on the losing end of international competition for those newer, I don't want to buy that stuff from China. I don't want to be buying it from the EU. I want our American industries to be the leaders in that. And if our fossil fuel industry is trying to sabotage our clean energy industry for immediate market share advantage, it is doing a long term disservice to the economy and to the well-being of our country.

So I think that the cost questions are real ones, but I think they are answered in the context of how we do something intelligent about solving what is a very, very real problem. And I thank the witnesses for sharing their various views. We will keep the record of the hearing open for 2 weeks for anyone who wishes to add anything further to the record and for those who have been asked to provide something to provide it for the record.

I look forward to working with my colleagues and I hope sooner rather than later, even with Republican colleagues, to address climate change and carbon pollution. Because you can get into discussions about what climate modeling tells you, but you can't debate the acidification of the seas. You can't debate the 10 inches of sea level rise that my tide gauge in Newport, Rhode Island, has already seen. You can't debate that Narragansett Bay is already 3 or 4 degrees warmer in the winter.

So you want to set aside the argument where there is modeling fights. Let's look at the areas where we are really hurting ourselves, and then it is, as Dr. Dessler said, virtually certain with any, what was the word, epistemological certainty, I think you said. Good words to close by. Thank you very much.

[Whereupon, at 1:12 p.m., the committee was adjourned.]

[Additional material submitted for the record follows:]

FRED UPTON, MICHIGAN
CHAIRMAN

HENRY A. WAXMAN, CALIFORNIA
RANKING MEMBER

ONE HUNDRED THIRTEENTH CONGRESS
Congreſs of the United States
House of Repreſentatives
COMMITTEE ON ENERGY AND COMMERCE
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Majority (202) 225-2927
Minority (202) 225-3641

November 15, 2013

The Honorable Gina McCarthy
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Dear Administrator McCarthy:

We write regarding your agency's recently proposed "Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units" signed on September 20, 2013 pursuant to Section 111 of the Clean Air Act (CAA). As proposed, the rule would establish carbon dioxide emission standards for new fossil fuel-fired power plants and require that new coal-fired power plants in the United States install carbon capture and storage (CCS) technologies that are not commercially viable. In this proposed rule, we believe that EPA is proposing to impose standards beyond the scope of its legal authority, and we respectfully request the agency withdraw the proposed rule.

Section 111 of the CAA authorizes EPA to set emissions standards for certain listed stationary sources and pollutants. Under Section 111, however, EPA may only impose emissions standards that would require the use of technologies that have been "adequately demonstrated." In the proposed rule, EPA maintains that CCS technologies for coal-fired power plants have been "adequately demonstrated" based on three government-funded CCS projects under the Department of Energy's Clean Coal Power Initiative (CCPI), including a project under construction in Mississippi, and two planned projects in Texas and California. EPA also cites a fourth small-scale, Canadian government-funded CCS project under construction in Saskatchewan, Canada. During our hearing this week on EPA's proposal, Acting Assistant Administrator Janet McCabe confirmed that the agency uses these four projects as the basis for meeting the statutory requirement that CCS technologies be adequately demonstrated for coal-fired power plants.

While EPA maintains that CCS for commercial coal-fired power plants is "adequately demonstrated" based on these government-funded projects, the Energy Policy Act of 2005 prohibits EPA from setting a performance standard under CAA Section 111 for commercial power plants based on the use of technology at CCPI projects. The Energy Policy Act of 2005 specifically prohibits EPA from considering technology used at a facility receiving assistance under the Department of Energy's CCPI, or at a facility that is receiving an advanced coal project tax credit, as being "adequately demonstrated" for purposes of Section 111 of the CAA.[1] Under these provisions of the Energy Policy Act of 2005, EPA's consideration of CCPI projects to determine that CCS for coal-fired power plants is "adequately demonstrated" is prohibited.

In light of these statutory prohibitions, we request that the EPA's proposed rule, which has not yet been published in the Federal Register, be withdrawn. This will ensure that the agency does not propose standards beyond its legal authority. This will also ensure that stakeholders and the public will not have to incur additional costs to respond to a proposal that contravenes applicable law.

We request that you advise the Committee of the agency's planned actions with regard to this request not later than November 22, 2013. If you have any questions, please contact Tom Hassenboehler or Mary Neumayr of the Majority Committee staff at (202) 225-2927.

Sincerely,

Ed Whitfield

Fred Upton
Chairman

Ed Whitfield
Chairman
Subcommittee on Energy and Power

Joe Barton

Joe Barton
Chairman Emeritus

Steve Scalise
Vice-Chair
Subcommittee on Energy and Commerce

cc: The Honorable Henry A. Waxman, Ranking Member
The Honorable Bobby L. Rush, Ranking Member, Subcommittee on Energy and Power

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[1] *See* 42 U.S.C 15962(i) ("No technology, or level of emission reduction solely by reason of the use of technology, or the achievement of the emission reduction by 1 or more facilities receiving assistance under this Act, shall be considered to be . . . adequately demonstrated for purposes of [section 111 of the Clean Air Act] . . ."); 26 U.S.C. 48A(g) ("No use of technology . . . at one or more facilities with respect to which a credit is allowed under this section, shall be considered to indicate that the technology . . . is adequately demonstrated for purpose of section 111 of the Clean Air Act"); *see also* H. Comm. on Energy and Commerce, Report on H.R. 1640, "Energy Policy Act of 2005," H.R. Rept. No. 109-215 at 239-40 (July 29, 2005) (July 29, 2005)("the use of a certain technology by any facility assisted under this subtitle . . . will not result in that technology . . . being considered achievable, achievable in practice, or 'adequately demonstrated' for purposes of [section 111 of the Clean Air Act]").

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States

House of Representatives

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December 19, 2013

The Honorable Gina McCarthy
Administrator
Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, D.C. 20004

Dear Administrator McCarthy,

Science is a valuable tool to help policymakers navigate complex issues. However, when inconvenient facts are disregarded or when dissenting voices are muzzled, a frank discussion becomes impossible. The Environmental Protection Agency (EPA) cannot continue to rush ahead with costly regulations without allowing time for a real-world look at the science.

We are concerned about the Agency's apparent disregard for the concerns of its science advisors. On December 3, 2013, Chairman Smith wrote to you about the troubling findings of the Science Advisory Board's (SAB) Work Group highlighting problems with the science that underlies the proposed New Source Performance Standards (NSPS) for power plants.[1] The Work Group showed that EPA rushed ahead with its costly power plant proposal without waiting for the advice of its independent science advisors and that the underlying science lacked adequate peer review.[2]

These discoveries raised serious questions about EPA's proposed rule and clearly merited further review. However, when these concerns were raised, a senior official in the EPA Air Office sought to distance the Agency from the criticisms leveled by the SAB Work Group. Specifically, the EPA claimed that the NSPS is not "setting any requirements on sequestration and not providing any analysis as such because we don't speak to the sequestration."[3] The claim that the rule doesn't need to address storage concerns highlights your Agency's continued lack of transparency and consistent attempts to avoid accountability.

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[1] Standards of Performance for Greenhouse Gas Emission from New Stationary Sources: Electric utility Generating Units (Sept. 20, 2013).

[2] Memorandum from SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science to Members of the Chartered SAB and SAB Liaisons, Nov. 12, 2013.

[3] *SAB Suggests Dropping Review Of CCS In Utility NSPS After EPA Pushback*, InsideEPA, Dec. 5, 2013 (quoting Peter Tsirigotis, Director, Sector Policies and Programs Division, Office of Air and Radiation, US EPA).

While the Agency admitted that there are some unanswered scientific issues regarding carbon capture and storage (CCS) systems, the official noted that "most of those things are outside of this rulemaking."[4] Because long-term geologic storage encompasses new science and lacks a proven regulatory framework,[5] EPA attempted to avoid the obvious questions regarding storage of carbon. In particular, EPA deflects the concerns raised by its science advisors by claiming that the charges of inadequate peer-review relate to studies beyond the scope of the NSPS proposal. In other words, EPA wants people to believe that the rule's regulatory footprint only covers carbon capture, without addressing what happens to the captured carbon.

The Agency's distinction rings hollow. The new mandates in the NSPS rule will create regulatory burdens and litigation risks that could make carbon dioxide from power plants no longer economically viable for use in enhanced oil recovery (EOR) operations. But since EOR is currently the only way to comply with the new power plant rule,[6] this would impede both the practical operation of the rule and erect unnecessary barriers to the use of EOR. As you know, the Committee has already raised concerns with the Agency's premature declaration of "adequate demonstration" of CCS under the Clean Air Act; unintended burdens on EOR further complicate the analysis.

In order to operate as intended, the proposed NSPS rule demands that carbon captured by CCS technology be made available for use in EOR. In fact, EPA notes in the proposed rule that "the cost of 'full capture' CCS without EOR is outside the range of costs that companies are considering for comparable generation and therefore should not be considered [a Best System of Emissions Reduction] for CO2 emissions for coal-fired power plants."[7] Further, EPA recently argued before the U.S. Supreme Court that its Clean Air Act authority should "ensure that the reductions that had to take place were done in the most cost-effective manner possible."[8]

The importance of being able to use carbon dioxide from power plants in EOR operations was confirmed at the Science Committee's October 29, 2013, hearing on the NSPS proposal. The hearing identified a range of concerns about whether the CCS technology necessary to comply with the proposed rule is commercially ready. In response to our concerns, we were assured that the use of carbon dioxide in EOR operations would be an important part of the way that the NSPS rule would function. For example, Kurt Waltzer, of the Clean Air Task Force, stated that "wide use of carbon dioxide captured from power and industrial plants is vital to expanded use of [EOR] in the U.S. that will increase U.S. oil production and decrease dependence on foreign oil."[9]

Furthermore, testimony in our October hearing made the point that the cost of CCS related operations will be an important part of whether the rule, and the President's larger climate initiatives, can operate effectively. Charles McConnell, from Rice University and a former Assistant Secretary of Energy in the Obama Administration, explained that the President's carbon-related objectives "can only be achieved through the broad global deployment of low cost, commercially viable technology for capturing and permanently and safely storing/utilizing CO_2 from all fossil energy sources."[10]

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[4] *Id.*

[5] In fact, no one has ever successfully obtained the necessary permit to permanently store carbon dioxide under EPA's Class VI injection wells. Consequently, Enhanced Oil Recovery (EOR) is currently the only means of satisfying the terms of the NSPS mandate.

[6] See *supra* at n. 4.

[7] Standards of Performance for Greenhouse Gas Emission from New Stationary Sources: Electric Utility Generating Units (Sept. 20, 2013), prepublication version at 30-31.

[8] Transcript of US EPA, et al. v. EME Homer City Generation, L.P., et al., (U.S. Dec. 10, 2013)(No. 12-1182)(argument of Deputy Solicitor General on behalf of EPA) at 32.

[9] *EPA Power Plant Regulations: Is the Technology Ready?*, Subcomm. On Env. Of the H. Comm. On Science, Space, and Technology, 113th Cong. (Oct. 29, 2013) (testimony of Kurt Walzer at 2).

Indeed, the most widely cited example of a CCS development project—the Kemper County, Mississippi project—is predicated on integrating carbon capture with state-of-the-art use of the carbon for EOR purposes. When you testified before our Committee on November 14th, the only domestic project you could name was, in fact, this same project. Although there have been significant delays and cost-overruns, as with any untested technology, we believe the Kemper County project holds promise and will advance our understanding of the science and economics of CCS. However, given the prohibitions of the Energy Policy Act of 2005 (EPAct),[11] this project alone cannot form the basis of adequate demonstration under the Act. Moreover, the encumbrances the NSPS rule unnecessarily places on EOR operations further calls into question whether Kemper can be the basis for such a regulation.

Given the importance EPA places on using EOR to offset the incredible costs of CCS technologies,[12] we are confounded as to why the NSPS rule includes language that would impose new regulatory burdens on EOR operators who seek to use carbon captured from power plants. Specifically, the proposal would require EOR operators to meet new reporting obligations under Subpart RR of the Greenhouse Gas (GHG) reporting rules.[13] Although these Subpart RR reporting rules have always been voluntary, the NSPS would make them mandatory for EOR operators. With this new requirement the EPA quietly declares war on EOR.

This new Agency mandate—placed only on carbon captured to satisfy the NSPS rule for power plants—creates a variety of new regulatory costs. For example, Subpart RR reporting requires that operators draft and obtain EPA approval for monitoring, reporting, and verification (MRV) plans. Not only will such MRV plans be costly to create and administer, the process for approving these plans is likely to result in litigation that will add both costs and delays for EOR operators.

All of these burdens are being imposed on an industry unrelated to power plants and with no clear justification. As EPA noted in the 2010 final GHG rule, the reporting mandates do not directly advance public health.[14] These unnecessary additional costs and delays would be avoided if EPA continued to allow EOR operators accepting power plant CO_2 to report under Subpart UU, which EPA identified in its final GHG reporting rule as the more appropriate for EOR operators.[15]

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[10] *EPA Power Plant Regulations: Is the Technology Ready?*, Subcomm. On Env. Of the H. Comm. On Science, Space, and Technology, 113th Cong. (Oct. 29, 2013) (testimony of Charles D. McConnell at 3).

[11] 42 U.S.C. § 15962(i). *See also* Letter from Chairman Lamar Smith to Administrator McCarthy, Nov. 6, 2013.

[12] Standards of Performance for Greenhouse Gas Emission from New Stationary Sources: Electric utility Generating Units (Sept. 20, 2013), prepublication version at 30-31.

[13] *Id.* at 279.

[14] Instead, the Agency claimed that the "greatest benefit of mandatory reporting…will be realized in developing future GHG policies." Mandatory Reporting of Greenhouse Gases: Injection and Geologic Sequestration of Carbon Dioxide; Final Rule, 75 Fed. Reg. 75,060 (Dec. 1, 2010) at 75,075.

[15] *Id.* at 75,076.

Further, the NSPS mandates that the EPA imposes on EOR operators are not the only new regulatory burdens operators must shoulder. The NSPS rule must be placed in the context of other rules EPA is pushing through. For example, the Office of Management and Budget has completed its review of an EPA final rule that addresses whether compressed carbon dioxide should be treated as a hazardous waste under the Resource Conservation and Recovery Act (RCRA). We understand that this rule would potentially grant conditional exclusions to particular types of carbon dioxide streams.

While, such a rule seems sensible, it may in fact create substantial uncertainties. For example despite their constructive and commercially important use in EOR, EPA's rule may classify these carbon dioxide streams as "solid waste." Practically speaking, that would mean exposing EOR operators to potential liability under RCRA. If the Agency merely creates a narrow carve-out for Class VI storage wells, it may fail to protect the use of carbon dioxide incidentally stored or injected for EOR purposes. The Agency must ensure that RCRA doesn't create additional obstacles to the use of anthropogenic carbon for EOR activities. The EPA cannot afford to ignore the complex consequences of its rules in real-world applications. Ultimately, the American people will bear the burden if the Agency ignores the cumulative effects of the rule-making web EPA continues to weave.

It is unacceptable that the Agency's power plant rule would create new obstacles to the very technology that the rule purports to advance. Accordingly, we look forward to your explanation regarding the justification for including the new reporting requirements in the proposed rule. We also request any analysis prepared by EPA on the costs associated with this specific provision and how those costs may affect the economic viability of the use of power plant CO_2 in EOR operations. Clearly, this rule covers the entire system of emissions reductions, and as such, EPA must address both the feasibility of new capture technologies and the unanswered concerns about storage of captured carbon.

The EPA's proposed power plant regulations will put Americans out of work and will make electricity more expensive and less reliable. It is misleading and dangerous for EPA to quietly dismiss inconvenient facts and ignore the real-world consequences of its costly regulations. Americans deserve honesty.

Thank you for your prompt attention to this matter.

Sincerely,

Lamar Smith
Lamar Smith
Chairman

Rep. Dana Rohrabacher
Vice Chair

Ralph M. Hall
Rep. Ralph M. Hall

Rep. F. James Sensenbrenner, Jr.

Frank D. Lucas
Rep. Frank D. Lucas

Rep. Michael T. McCaul

Rep. Steven M. Palazzo

Rep. Randy Hultgren

Rep. Steve Stockman

Cynthia M. Lummis
Rep. Cynthia Lummis

Thomas Massie
Rep. Thomas Massie

Jim Bridenstine
Rep. Jim Bridenstine

Chris Collins
Rep. Chris Collins

Randy Neugebauer
Rep. Randy Neugebauer

Paul C. Broun
Rep. Paul C. Broun

Mo Brooks
Rep. Mo Brooks

Larry Bucshon
Rep. Larry Bucshon

Bill Posey
Rep. Bill Posey

Rep. David Schweikert

Kevin Cramer
Rep. Kevin Cramer

Randy K. Weber
Rep. Randy Weber

cc: David T. Allen, Chair, Science Advisory Board.
James R. Mihelcic, Chair, Science Advisory Board Work Group on EPA Planned Actions
Rep. Eddie Bernice Johnson, Ranking Member, Committee on Science, Space, and Technology

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DRAFT

December __, 2013

The Honorable Regina A McCarthy
Administrator
Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Re: BACT Availability Determinations

Dear Administrator McCarthy:

Having served on the EPA's Environmental Finance Advisory Board (EFAB) and having had the lead on its initial review of Carbon Capture and Sequestration (CCS) financing, I compliment you for utilizing the capabilities of this talented group and hopefully you will continue to benefit from their services.[1]

Attached please find a report prepared by the Center for Regulatory Effectiveness (CRE),[2] *Carbon Capture and Sequestration: EPA's Technology Availability Determinations Need to be Reproducible.* The paper concludes that, under the Data Quality Act (DQA), EPA's BACT determinations are influential information and are subject to the law's reproducibility requirements.

EPA's pre-dissemination review process for BACT determinations which ensures that such determinations are DQA compliant is one of the issues discussed in CRE's paper. Because of EPA's pre-dissemination review requirements:

- There is a need to begin immediately a review of EPA's database on CCS to determine if the agency's statements on CCS availability comply with the DQA.

  We believe that the traditional APA notice-and-comment period[3] is too confining to address the complexities inherent in DQA issues related to CCS. Consequently, we believe you should encourage non-Federal parties to develop a discussion forum which would allow all stakeholders to participate in the review at no cost to EPA.

- A public discussion of CCS availability needs to be interactive and continuing; we are beginning the debate by posting the attached paper for public comment on CRE's CCS BACT

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[1] For more information about my service on the EFAB, please see, **http://thecre.com/pdf/20090309_EFAB_2009-2010.pdf**.

[2] For more information about CRE, please see **http://www.thecre.com/oira/?page_id=8**.

[3] For more information on the inadequacy of public comment periods, please see **http://www.thecre.com/oira/?p=2175**.

Interactive Public Docket[4] (IPD) which is available at http://www.thecre.com/forum10/

The aforementioned IPD developed by CRE will provide stakeholders with a forum to submit data and subject it to peer review 24/7 after the termination of the notice and comment period.

EPA has the authority under existing law not only to review the comments contained in an IPD but also has the authority to upload comments of their choice from the IPD if the said comments have a precursor comment in the docket generated during the APA comment period. See *Portland Cement.*

Periodically CRE will review the comments posted on the IPD and submit the results of its analysis to EPA, OMB, Congressional Committee and make it available to the public by posting it on the IPD.

- To help spur public participation in the discussion process, we would appreciate EPA notifying the public of:

1. The availability of the CRE CCS BACT Interactive Public Docket http://www.thecre.com/forum10/ in the forthcoming Notice of Proposed Rulemaking or through other means and
2. Announce the agency's views on whether its BACT determination for CCS is compliant with the DQA and its implementing guidance and if so providing the public with the relevant documentation in support of the agency's conclusion.

Respectfully,

Jim Tozzi
Member, Board of Advisors

Attachment, *Carbon Capture and Sequestration: EPA's Technology Availability Determinations Need to be Reproducible.*

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[4] See, **http://en.wikipedia.org/wiki/Interactive_Public_Docket**.

DRAFT

CARBON CAPTURE AND SEQUESTRATION: EPA'S TECHNOLOGY AVAILABILITY DETERMINATIONS NEED TO BE REPRODUCIBLE

December 2013

Bruce Levinson
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Center for Regulatory Effectiveness

DRAFT

CARBON CAPTURE AND SEQUESTRATION: EPA'S TECHNOLOGY AVAILABILITY DETERMINATIONS NEED TO BE REPRODUCIBLE

> *"In light of the issues we identified, we believe that...Carbon Program goals may not be achieved without implementation of corrective actions. Specifically, projects may not be completed, deliverables might not be received, job creation will not meet anticipated targets.... "*
>
> – DOE, Office of Inspector General, "Audit Report: DOE's Industrial Carbon Capture and Storage Program," March 2013.[1]
>
> *"To date, there are no commercial ventures in the United States that capture, transport, and inject industrial-scale quantities of CO2...."*
>
> – Congressional Research Service, September 30, 2013.[2]

Issue: Are Carbon Capture and Sequestration (CCS) Technologies Available?

For coal-fired power plants, and the consumers who depend on them, the defining issue at the center of EPA's Proposed Rule on greenhouse gas emissions from electricity generating units (RIN 2060-AQ91) is whether technologies to capture and store CO_2 are "available" as defined by the Clean Air Act Amendments (CAAA). If EPA determines that CCS technologies are available, then utilities will be required to install such equipment on new/revamped coal-powered generating stations.

The term *Best Available Control Technology* (BACT) is defined in the CAAA but it is EPA's job to decide whether or not a developing environmental technology is available. EPA's discretion in making BACT determinations is primarily regulated by two laws:

1. The Clean Air Act as amended which defines BACT; and
2. The Data Quality Act (DQA)[3] which sets enforceable quality standards for EPA information disseminations– including their BACT determinations.

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[1] Department of Energy, Office of Inspector General, "Audit Report: The Department of Energy's Industrial Carbon Capture and Storage Program Funded by the American Recovery and Reinvestment Act," March 2013, p. 15, http://energy.gov/sites/prod/files/2013/04/f0/OAS-RA-13-15_0.pdf.

[2] Peter Folger, Congressional Research Service, "Carbon Capture and Sequestration: Research, Development, and Demonstration at the U.S. Department of Energy," (CCS RD&D) September 30, 2013, Summary. http://www.fas.org/sgp/crs/misc/R42496.pdf.

[3] See, http://www.foreffectivegov.org/node/3479.

This paper will:

1. Discuss CCS technologies and their availability, based on recent federal data;
2. Review how the CAAA defines BACT; and
3. Place EPA's BACT determinations within the reproducibility requirements of the DQA.

What Is Carbon Capture and Sequestration?

The Congressional Research Service (CRS), in its CCS *Primer*, explains that "[C]arbon capture and sequestration (or storage)—known as CCS—is a physical process that involves capturing manmade carbon dioxide (CO_2) at its source and storing it before its release to the atmosphere."[4]

CRS also notes that the reason why CCS technologies are of interest to policy makers is not because CCS technologies are ready to be deployed, but rather because the "promise of CCS lies in the potential for technology to capture CO_2 emitted from large, industrial sources...."[5]

An integrated industrial CCS system would include three core "steps: (1) capturing CO_2 and separating it from other gases; (2) purifying, compressing, and transporting the captured CO_2 to the sequestration site; and (3) injecting the CO_2 in subsurface geological reservoirs or storing it in the oceans."[6]

> *For CCS to succeed at reducing CO_2 emissions from a significant fraction of large sources in the United States, CO_2 capture technology would need to be deployed widely. Widespread commercial deployment will likely depend on the cost of capturing CO_2.*
>
> – Congressional Research Service, 10/21/13

It is the "capture" portion of the CCS process that is the crux in determining its availability. As CRS has explained that "[u]nlike the other two components of CCS, transportation and geologic storage, the first component of CCS—CO_2 capture—is almost entirely technology-dependent."[7]

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[4] Peter Folger, Congressional Research Service, "Carbon Capture and Sequestration (CCS): A Primer," (Primer) July 16, 2013, p. 1. http://www.fas.org/sgp/crs/misc/R42532.pdf.

[5] Folger, Technology Assessment, p. 1.

[6] Folger, Primer, p.1.

[7] Peter Folger, Congressional Research Service, "Carbon Capture: A Technology Assessment," (Technology Assessment) October 21, 2013, p. 1. https://www.fas.org/sgp/crs/misc/R41325.pdf.

CRS does also note, however, that "transportation and sequestration costs, while generally much smaller than capture costs, could be very high in some cases."[8] CRS further explains that the magnitude of transportation and sequestration cost levels would "depend, in part, on how long it would take to reach an agreement on a regulatory framework to guide long-term CO_2 injection and storage, and on what those regulations would require."

A report from EPA's Environmental Financial Advisory Board (EFAB) to the agency discussing one component of sequestration costs, the financial assurance costs, made clear the magnitude of those costs when they stated,

> "*After an extensive review of the existing regulations for SDWA wells, in particular Class I and Class II wells, and RCRA facilities, the Board concluded that the RCRA and the SDWA financial assurance requirements for Class I wells rather than SDWA Class II wells provide the best model for establishing financial assurance requirements for new Class VI wells* [for geologic sequestration of carbon dioxide gas streams.] *The financial assurance requirements for Class I wells closely resemble the RCRA regulations.*"
>
> Letter from Environmental Financial Advisory Board to EPA Assistant Administrator, Office of Water, March 31, 2010. [Emphasis added] http://www.thecre.com/pdf/20100601_FinancialAssuranceUndergroundCarbonSequestrationMarch2010.pdf

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[8] Folger, Technology Assessment, p. 1.

How Does the CAAA and EPA Define Best Available Control Technology?

The statutory definition of BACT is complex and takes into account "economic impacts and other costs" along with engineering, environmental and other factors. The complete definition of BACT is available at 42 USC § 7479(3).[9]

EPA's BACT processes are implemented both directly and through guidance to states. CRS examined the specific question of "What Is EPA's Role in Determining BACT?" and explained that the "EPA procedure for determining BACT (required for federally run programs, encouraged for EPA-approved, state-run programs) is a fairly straightforward 'top-down' process" which is described in the CRS report.[10] The second and the fourth of the five steps outlined in the CRS report are worthy of particularly attention for understanding whether a technology is considered available.

Eliminate Technically Infeasible Control Options*—control options need to be either demonstrated on a like facility or determined to be both available and applicable in the particular case. If not, the option is eliminated from the list.*

– Congressional Research Service description of BACT Determination

Eliminate Options that Fail Energy, Environmental, or Economic Criteria*—the permitting agency has discretion in weighting the three statutory criteria for exclusion.*

– Congressional Research Service description of BACT Determination

The second of EPA's tasks in making a BACT determination described by CRS is for the agency to eliminate from consideration those control options which have yet to "demonstrated" on a similar facility or determined to be both available and applicable in the given instance under consideration.

The fourth of the five steps outlined by CRS is the one in which EPA is to make sure that BACT determinations are economically reasonable. In discussing the portion of EPA's guidance to states on making delegated BACT determinations, CRS explains that EPA told states that "[i]n conducting the energy, environmental and economic impacts analysis, permitting authorities have 'a great deal of discretion' in deciding the specific form of the BACT analysis and the weight to be given to the particular impacts under consideration."[11]

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[9] Available at http://www.law.cornell.edu/uscode/text/42/7479.

[10] Larry Parker, James E. McCarthy, "EPA's BACT Guidance for Greenhouse Gases from Stationary Sources," ("BACT") Congressional Research Service, November 22, 2010, p. 3, *available at* https://www.fas.org/sgp/crs/misc/R41505.pdf.

[11] Parker and McCarthy, BACT, p. 14.

As we will see in the discussion of the DQA's reproducibility requirements below, that EPA's discretion in BACT determinations, while significant, is limited by statutory quality constraints implemented by the White House Office of Management and Budget (OMB) and EPA.

Are CCS Technologies Commercially Available?

Although CRS said that, to date, "there are no commercial [CCS] ventures in the United States" they also said that one "project, the Kemper County Facility, has received $270 million from DOE under its Clean Coal Power Initiative Round 2 program, and is slated to begin commercial operation in May 2014."[12] The Kemper project is a 582 MW IGCC [Integrated Gasification Combined Cycle] power plant that is currently under construction in Kemper County, Mississippi. The plant will include a CCS system designed to capture approximately 65 percent of the produced CO2."[13]

> *"The Kemper IGCC project, which received a $270 million federal grant and $412 million in federal tax credits, recently announced that it will miss its May 2014 completion deadline. Delays at the Kemper IGCC project have contributed to an almost $5 billion cost that is almost double the original estimated cost of around $2.8 billion."*
>
> – Testimony of Anthony S. "Tony" Campbell
> President & CEO
> East Kentucky Power Cooperative
> *before* US House of Representatives.
> November 14, 2013

The Kemper project received, as was noted above, partial funding from the Department of Energy (DOE). DOE, as CRS explains, has a "CCS research, development, and demonstration (RD&D) program" with the "its vision of developing an advanced CCS technology portfolio ready by 2020 for large-scale CCS deployment."[14]

CRS noted that "EPA *asserts* that CCS technology is currently feasible and refers to a coal gasification project that is over 75% complete: the Kemper County Project."[15] [Emphasis added] The Kemper project, however, has experienced significant setbacks. For example, CRS notes that "the company announced that capital costs would be closer to $3.4 billion, approximately $1 billion higher than original cost estimates for the plant."[16]

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[12] Folger, CCS RD&D, Summary.

[13] US Environmental Protection Agency, "Proposed Rule: Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units," RIN 2060-AQ91, signed on 9/20/2013, p. 28 of 463.

[14] Ibid.

[15] Folger, CCS RD&D, p. 9.

[16] Ibid., pp 9-10.

> *"Since the original proposal, progress on Southern Company's Kemper County Energy Facility, an IGCC facility that will implement partial CCS, has continued, and the project is now over 75 percent complete."*
>
> – US EPA , GHG Emission NPRM, Page 21 of 463, 9/20/2013

> *"Cost overruns at the Kemper Plant, however, have raised questions over the relative value of environmental benefits due to CCS technology compared to construction costs of the facility and its effect on ratepayers."*
>
> – Congressional Research Service, Summary, 9/30/2013

More recently, the President and CEO of a rural Kentucky power cooperative testified that the Kemper project is delayed and will not be ready by its previously anticipated May 2014 completion.[17] The delays in bringing CCS projects to fruition is not surprising since extensive delays are common for advanced industrial emission control technologies. On this point, CRS noted that "[i]n the case of SO_2 and NOx scrubbers, efforts typically took two decades or more to bring new concepts (such as combined SO2 and Nox capture systems) to the commercial stage."[18]

Kemper is not the only the CCS which is experiencing significant difficulties. CRS' report on CCS projects noted that "DOE's flagship CCS demonstration project, FutureGen, which has experienced delays and multiple changes of scope and design since its inception in 2003."[19]

CRS reviews the FutureGen project, including its changes in project direction, and states that it remains an open question as to "whether FutureGen represents a unique case of a first mover in a complex, expensive, and technically challenging endeavor, or whether it represents all large CCS demonstration projects once they move past the planning stage."[20]

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[17] Testimony of Anthony S. "Tony" Campbell, before Subcommittee on Energy and Power, Committee on Energy and Commerce, US House of Representatives, November 14, 2013, *available at* http://www.nreca.coop/wp-content/uploads/2013/11/TonyCampbellTestimony111413.pdf p.4

[18] Folger, CCS RD&D, p. 9.

[19] Ibid, Summary.

[20] Ibid, p. 18.

Is EPA Right About CCS Availability?
The Need to Test EPA's BACT Determinations Through Reproducibility

The CRS report on EPA's BACT guidance document makes clear that the regulatory agency has significant discretion in making BACT determinations. EPA's BACT discretion, however, is not unlimited and is regulated by the *good government* laws that "regulate the regulatory process" including the Administrative Procedure Act and the DQA.[21]

The DQA was described by public policy researchers supported by the National Science Foundation (NSF) as "a radical change in regulatory policymaking"[22] and "one of the most significant regulatory reforms over the past twenty-five years."[23]

In addition to setting general requirements for the quality, objectivity, utility and integrity of virtually all Executive Branch information disseminations, the DQA sets particularly stringent requirements for the most important information the government disseminates, information which is *influential.* OMB states that influential information "means that the agency can reasonably determine that dissemination of the information will have or does have a clear and substantial impact on important public policies or important private sector decisions."[24]

EPA's agency-specific guidelines implementing the DQA go into considerable discussion regarding what the agency considers to be influential information. There is no doubt that EPA CCS BACT determinations will be influential information as they are unquestionably in support of a top Agency action.

> *"EPA will generally consider the following classes of information to be influential...*
>
> - *Information disseminated in support of top Agency actions (i.e., rules, substantive notices, policy documents, studies, guidance) that demand the ongoing involvement of the Administrator's Office and extensive cross-Agency involvement; issues that have the potential to result in major cross-Agency or cross-media policies, are highly controversial, or provide a significant opportunity to advance the Administrator's priorities. Top Agency actions usually have potentially great or widespread impacts on the private sector, the public or state, local or tribal governments. This category may also include precedent-setting or controversial scientific or economic issues."*
>
> – Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by the Environmental Protection Agency, p. 19.

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[21] See, Five Governors of the Regulatory State, http://www.thecre.com/pdf/20110530_Governors_of_the_Regulatory_State.pdf.

[22] Ken Godwin, et al, "Lobbying and Policymaking," Sage/CQPress: Los Angeles, 2013, p. 63.

[23] Godwin, p. 70.

[24] OFFICE OF MANAGEMENT AND BUDGET, Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies, Effective Date: January 3, 2002. http://www.whitehouse.gov/omb/fedreg_reproducible.

Reproducibility: The Core Requirement for Influential Information

Reproducibility is at the heart of federal quality standards for influential information. OMB's government-wide information quality guidelines state that "OMB believes that a reproducibility standard is practical and appropriate for information that is considered 'influential', as defined in paragraph V.9 - that 'will have or does have a clear and substantial impact on important public policies or important private sector decisions.'"

EPA gives significant consideration to the agency's vigorous implementation of the law. The regulatory agency explains that,

> "*these Guidelines provide for the use of especially rigorous 'robustness checks' and documentation of what checks were undertaken. These steps, along with transparency about the sources of data used, various assumptions employed, analytic methods applied, and statistical procedures employed should assure that analytic results are 'capable of being substantially reproduced.'*"
>
> – EPA Information Quality Guidelines, p. 47.

The Washington-based NGO, The Center for Effective Government[25] has published an in-depth analysis of the DQA and its implementing guidelines, including the reproducibility requirement provisions.[26] The Center for Effective Government explained reproducibility that "is applied differently for three types of 'influential' information...." With respect to the DQA's reproducibility requirement, the NGO states:

> *"For [influential] "analysis results" there must be 'sufficient transparency about data and methods that an independent reanalysis could be undertaken.' OMB adds that this means that 'independent analysis of the original or supporting data using identical methods would generate similar analytic results, subject to an acceptable degree of imprecision or error.' However, the transparency necessary to achieve this is not meant to 'override other compelling interests such as privacy, trade secrets, intellectual property, and other confidentiality protections.' In such cases where the public does not have access to data and methods, 'agencies shall apply especially rigorous robustness checks to analytic results and document what checks were undertaken.'"*
>
> – Center for Effective Government http://www.foreffectivegov.org/node/3479

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[25] See, http://www.foreffectivegov.org/about-us.

[26] See, Data Quality Act, Center for Effective Government, http://www.foreffectivegov.org/node/3479.

Is Reproducibility a Reasonable Requirement for BACT Determinations?

Reproducibility checks are applied to quantitative data, such as financial statements and scientific measurements. The issue may arise as to whether it is appropriate to apply reproducibility requirements to the results of an EPA determinative process, a process which provides the agency with a degree of discretion. The practicality and appropriateness of applying the DQA's reproducibility requirement to agency evaluations of unique situations, such as BACT availability determinations, is an issue worth serious consideration.

> "*As all of you know, of course, questions have been raised about the robustness of priming results. The storm of doubts is fed by several sources, including the recent exposure of fraudulent researchers, general concerns with replicability that affect many disciplines, multiple reported failures to replicate salient results in the priming literature, and the growing belief in the existence of a pervasive file drawer problem that undermines two methodological pillars of your field: the preference for conceptual over literal replication and the use of meta-analysis. Objective observers will point out that the problem could well be more severe in your field than in other branches of experimental psychology, because every priming study involves the invention of a new experimental situation.*" [Emphasis added]
>
> – Open Letter from Daniel Kahneman, September 26, 2012

A review of the scientific literature makes clear that applying reproducibility checks to analytic, *i.e.*, cognitive, analysis is not only appropriate but also necessary. EPA's guidelines makes explicit the agency's commitment to applying reproducibility requirements to analytic results. The literature, however, makes clear that analytic validity requires that reproducibility requirements even be applied to unique situations in which every study "involves the invention of a new experimental situation."

In an open letter to the psychiatric research community,[27] Nobel laureate economist Daniel Kahneman[28] highlighted how problems with replicability of major psychological experiments, including "multiple reported failures to replicate salient results" has contributed to a "storm of doubts" about the robustness of the experimental results. The letter placed particular focus on a specialized area of psychological research, social priming, which concerns how early responses to a stimulus influence subsequent responses.[29]

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[27] Daniel Kahneman, A proposal to deal with questions about priming effects, September 26, 2012, http://www.nature.com/polopoly_fs/7.6716.1349271308!/suppinfoFile/Kahneman%20Letter.pdf

[28] See, http://en.wikipedia.org/wiki/Daniel_Kahneman.

[29] A brief overview of the social priming issue may be found in the Abstract for a research project supported by the National Science Foundation (NSF) which explained that the "ultimate goal of this line of research is to test for a causal role of appraisal, or internal evaluations, in eliciting emotional experience, and to test a key premise of a process model by examining the effects of incidentally primed appraisals on emotion and emotion-related behaviors."

The challenges in replicating the results of priming studies did not stop Daniel Kahneman from issuing his challenge. The letter included a call for reproducibility testing which bluntly stated: "I believe that you should collectively do something about this mess."

> *"I believe that you should collectively do something about this mess. To deal effectively with the doubts you should acknowledge their existence and confront them straight on, because a posture of defiant denial is self-defeating. Specifically, I believe that you should have an association, with a board that might include prominent social psychologists from other field. The first mission of the board would be to organize an effort to examine the replicability of priming results, following a protocol that avoids the questions that have been raised and guarantees credibility among colleagues outside the field."*
>
> – Open Letter from Daniel Kahneman,
> September 26, 2012

The research community responded affirmatively to Kahneman's challenge, successfully replicating many, but not all, classic experiments. A news article in *Nature* stated that "A large international group set up to test the reliability of psychology experiments has successfully reproduced the results of 10 out of 13 past experiments. The consortium also found that two effects could not be reproduced."[30]

The *Nature* news article explained that "[p]sychology has been buffeted in recent years by mounting concern over the reliability of its results, after repeated failures to replicate classic studies. A failure to replicate could mean that the original study was flawed, the new experiment was poorly done or the effect under scrutiny varies between settings or groups of people."[31] [Emphasis added]

The scientific literature demonstrates that it is both practical and necessary to apply a reproducibility requirement to the results of cognitive-based experiments, even those experiments that require "the invention of a new experimental situation." Thus, under the DQA and its implementing guidance, it is both practical and necessary for EPA to apply the reproducibility requirements for influential analytic results to their BACT availability determinations.

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http://nsf.gov/awardsearch/showAward?AWD_ID=0643248

[30] Ed Yong, "Psychologists strike a blow for reproducibility: Thirty-six labs collaborate to check 13 earlier findings," *Nature*, 26 November 2013, http://www.nature.com/news/psychologists-strike-a-blow-for-reproducibility-1.14232.

[31] Ibid.

CONCLUSIONS: THE DQA, REPRODUCIBILITY AND EPA'S BACT AVAILABILITY DETERMINATIONS

1. EPA's BACT availability determinations are *influential* analytic results under the Data Quality Act.

2. EPA has an affirmative duty under their Information Quality Guidelines to ensure that their BACT determinations meet all DQA requirements, including those more rigorous checks that are applied to influential information.[32]

3. OMB and EPA guidance documents require the agency to apply reproducibility checks to influential information.

4. The scientific literature demonstrates the need to apply reproducibility checks to analyses of unique circumstances. The literature also demonstrates the practicality of applying reproducibility testing to analyses of subjective cognitive processes.

5. Ample CCS data exists to support the filing of a Data Quality Request for Correction against any EPA information disseminations indicating that the agency has determined that CCS technologies are BACT for industrial-scale coal-power generating plants.

> *"The plan for the Many Labs project was vetted by the original authors where possible, was documented openly, and was registered with the journal Social Psychology and its methods were peer-reviewed before any experiments were done. The results have now been submitted to the journal and are available online. 'That sort of openness should be the standard for all research,' says Daniel Simons of the University of Illinois at Urbana–Champaign, who is coordinating a similar collaborative attempt to verify a classic psychological effect not covered in the present study. 'I hope this will become a standard approach in psychology.'*
>
> *Oppenheimer says that other disciplines could benefit from Many Labs' approach. 'Psychology isn't the only field that has had issues with replication in recent years.'"*
>
> – *Nature*, Psychologists strike a blow for reproducibility, 26 November 2013

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[32] See, "Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by EPA," Section 7. Administrative Mechanism for Pre-dissemination Review," p. 29.

Hutson, Nick

From: Frey, Nathan J. [Nathan_J._Frey@omb.eop.gov]
Sent: Tuesday, November 19, 2013 5:22 PM
To: Wayland, Robertj
Cc: Culligan, Kevin; Hutson, Nick
Subject: RE: NSPS

Thanks Bob. I look forward to the discussion as soon as folks there are able. In the meantime, lots of folks are confused as to why the rule hasn't yet published in the FR. Are there particular reasons for this?

Happy to chat if easier.

Best,

Nathan
(202) 395 7345

From: Wayland, Robertj [mailto:Wayland.Robertj@epa.gov]
Sent: Tuesday, November 19, 2013 5:18 PM
To: Frey, Nathan J.
Cc: Culligan, Kevin; Hutson, Nick
Subject: RE: NSPS

Nathan –

The letter just got down to my desk today, so we are still working through the issues with OGC/management and will follow up with you once we have a more complete assessment. However, our initial assessment is that we can address the concerns that have been raised, but we're just working through the best way to do that. As soon as we have some resolution internally, we'll be glad to have a discussion with you and others.

thanx!

bob

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DRAFT/Deliberative Document - FOIA Exempt
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From: Frey, Nathan J. [mailto:Nathan_J._Frey@omb.eop.gov]
Sent: Tuesday, November 19, 2013 3:55 PM
To: Culligan, Kevin; Wayland, Robertj; Hutson, Nick
Subject: FW: NSPS

Hi all,

Can we discuss at your earliest convenience?

The Inside Story

GOP Says Utility NSPS Runs Afoul Of Energy Law

Posted: November 15, 2013

In a new line of attack on EPA's proposed greenhouse gas (GHG) rule for new coal-fired power plants, House Republicans are citing a Bush-era energy law that they say bars the agency from citing carbon capture and sequestration (CCS) projects funded by the law to justify its proposed mandate that new coal plants install the technology.

In a Nov. 15 letter to EPA Administrator Gina McCarthy, House Energy and Commerce Committee Chair Fred Upton (R-MI), along with three other Republicans on the committee, say EPA's new source performance standard (NSPS) runs afoul of existing prohibitions on using projects funded through the Energy Policy Act of 2005 as being "adequately demonstrated" under section 111 of the Clean Air Act.
EPA in its utility NSPS proposed Sept. 20 requires new coal-fired power plants to install CCS, saying that four nearly complete but not yet operational power plants that are installing the technology allows the agency to meet a statutory requirement that the technology is "adequately demonstrated." The four plants are located in Mississippi, Texas, California and Canada.

But Republicans have previously faulted EPA for requiring new coal plants to install CCS, even though the technology is not yet in commercial operation and have charged that the technology is not "adequately demonstrated."

Rep. Ed Whitfield (R-KY) and Sen. Joe Manchin (D-WV) have proposed draft legislation that would force EPA to base its NSPS on the carbon dioxide emission rates of existing plants, rather than plants being constructed, among many other restrictions.

But in a new line of attack, Republicans say EPA is legally barred from using those CCS utility projects to meet the "adequately demonstrated" standard in section 111 of the Clean Air Act under provisions in the Energy Policy Act of 2005, which provided funding for the Department of Energy's Clean Coal Power Initiative (CCPI).
"The Energy Policy Act of 2005 specifically prohibits EPA from consideration technology used at a facility receiving assistance under the Department of Energy's CCPI, or at a facility that is receiving an advanced coal project tax credit, as being 'adequately demonstrated' for purposes of Section 111 of the [Clean Air Act]," the letter says.

A GOP aide for the energy committee says that the three U.S. CCS projects -- Southern Company's Kemper facility, the Summit Project in Texas and the Hydrogen Energy California Project -- all received assistance through the CCPI.

As a result, the letter, which was also signed by Whitfield and Reps. Joe Barton (R-TX) and Steve Scalise (R-LA), says that because of the prohibitions, EPA should withdraw the proposed rule to "ensure that the agency does not propose standards beyond its legal authority."

Rep. Randy Neugebauer (R-TX) also raised the issue at a Nov. 14 House science committee hearing with EPA Administrator Gina McCarthy, saying the energy law provision prevents projects that receive CCPI funding from being used as examples of commercially available technology for regulatory purposes.

In response, McCarthy defended the agency's approach, saying that "we're regulating and proposing this under the Clean Air Act" and that "there is no question it's available, the question really is, is it reasonable and cost-effective for the sector?"

An EPA spokeswoman says the agency is reviewing the letter and will respond.

Arctic Report Card: *Update for 2013*
Tracking recent environmental changes

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Lake Ice
Permafrost

Sea Ice

D. Perovich[1,2], S. Gerland[3], S. Hendricks[4], W. Meier[5], M. Nicolaus[4], J. Richter-Menge[1], M. Tschudi[6]

[1]ERDC - CRREL, 72 Lyme Road, Hanover USA
[2]Thayer School of Engineering, Dartmouth College, Hanover, NH, USA
[3]Norwegian Polar Institute, Fram Centre, Tromsø, Norway
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[5]NASA Goddard Space Flight Center, Greenbelt, MD, USA
[6]Aerospace Engineering Sciences, University of Colorado, Boulder, CO, USA

December 17, 2013

Highlights

- The September 2013 Arctic sea ice minimum extent was 5.10 million km^2. This was 1.69 million km^2 greater than the record minimum set in 2012, but was still the sixth smallest ice extent of the satellite record (1979-2013).
- The amount of first year sea ice continues to increase, accounting for 78% of the ice cover in March 2013.
- A satellite-derived, Arctic Ocean-wide decrease in sea ice freeboard, from 0.23 m in March 2011 to 0.19 m in March 2013, implies a 0.32 m decrease in ice thickness, from 2.26 m to 1.94 m.

Sea Ice Extent

Sea ice extent is used as the basic description of the state of the Arctic sea ice cover. Satellite-based passive microwave instruments have been used to determine sea ice extent since 1979. There are two months each year that are of particular interest: September, at the end of summer, when the sea ice reaches its annual minimum extent, and March, at the end of winter, when the ice is at its maximum extent. The sea ice extent in March 2013 and September 2013 are presented in **Fig. 19**.

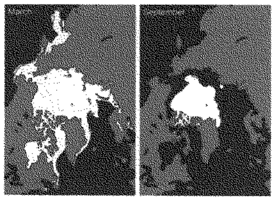

Fig. 19. Sea ice extent in March 2013 (left) and September 2013 (right), illustrating the respective monthly averages during the winter maximum and summer minimum extents. The magenta lines indicate the median ice extents in March and September, respectively, during the period 1981-2010. Note that the median ice extents are computed over a different time interval than the one (1979-2000) used in previous Arctic Report Cards, as explained by NSIDC at http://nsidc.org/data/seaice_index/baseline-change.html. Maps are from NSIDC at nsidc.org/data/seaice_index.

Based on estimates produced by the National Snow and Ice Data Center (NSIDC) the sea ice cover reached a minimum annual extent of 5.10 million km^2 on September 13, 2013. This was substantially higher (1.69 million km^2) than the record minimum of 3.41 million km^2 set in 2012 (**Fig. 20**), making it the largest September minimum ice extent since 2006. However, the 2013 summer minimum extent was still 1.12 million km^2 below the 1981-2010 average minimum ice extent. In March 2013 ice extent reached a maximum value of 15.04 million km^2 (**Fig. 20**), 3% below the 1981-2010 average. This was slightly less than the March 2012 value, but was typical of the past decade.

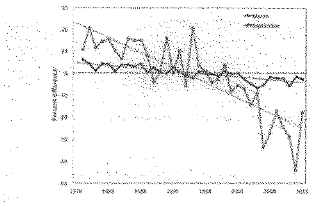

Fig. 20. Time series of ice extent anomalies in March (the month of maximum ice extent) and September (the month of minimum ice extent). The anomaly value for each year is the difference (in %) in ice extent relative to the mean values for the period 1981-2010. The black and red lines are least squares linear regression lines. The slopes of these lines indicate ice losses of -2.6% and -13.7% per decade in March and September, respectively.

Sea ice extent has decreasing trends in all months and virtually all regions (the exception being the Bering Sea during winter). As of 2013, the September monthly average trend is -13.7% per decade relative to the 1981-2010 average (**Fig. 20**). This is slightly lower than the trend (-14% per decade relative to the 1981-2010 average) in 2012, which was the twelfth consecutive year of progressively larger trends of summer ice retreat. Trends are smaller during March (-2.4% per decade, **Fig. 20**), but are still decreasing and statistically significant.

There was a loss of 9.69 million km^2 of sea ice between the March and September extents. This is the smallest seasonal decline since 2006. After reaching the March maximum extent, the seasonal decline began at a rate comparable to the 30-year average (not shown). Through the end of June the 2013 ice extent was just slightly less than the 30-year average values. For a few weeks in late-June and early-July the decrease in ice extent was greater than average. Subsequently, the 2013 ice extent tracked the shape of the average ice extent curve for the remainder of the summer melt season, but at a value about one million km^2 less than the average curve.

Age of The Ice

The age of the sea ice is another key descriptor of the state of the sea ice cover. The age of the ice is an indicator for its physical properties including surface roughness, melt pond coverage, and ice thickness. Older ice tends to be thicker and thus more resilient to changes in atmospheric and oceanic forcing than younger ice. The age of the ice can be determined using satellite observations and drifting buoy records to track ice parcels over several years (Tschudi et al. 2010). This method has been used to provide a record of ice age since the early 1980s (**Fig. 21**). The distribution of ice of different ages illustrates the extensive loss in recent years of the older ice types (Maslanik et al. 2011).

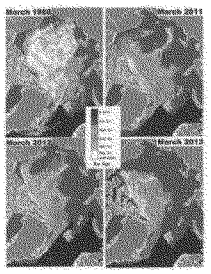

Fig. 21. Sea ice age in March 1988, 2011, 2012 and 2013, determined using satellite observations and drifting buoy records to track the movement of ice floes.

Although the minimum sea ice extent rebounded somewhat in 2013, the distribution of ice age continued to favor first-year ice (FYI, ice that has not survived a melt season), which is the thinnest ice type (e.g., Maslanik et al. 2007). In March 2013, FYI comprised 78% of the ice, up slightly from 75% in 2012. In March 1988, 58% of the ice pack was composed of first-year ice. Meanwhile, the trends continue for the recent loss of the oldest ice types, which accelerated starting in 2005 (Maslanik et al. 2011). For the month of March, the oldest ice (4 years and older) has decreased from 26% of the ice cover in 1988 to 19% in 2005 and to 7% in 2013.

At the end of winter 2013 little multiyear ice was detected in much of the Beaufort Sea (**Fig. 21**, lower right; and Richter-Menge and Farrell 2013). There is no precedent in the satellite-derived record of ice age for the near-absence of old ice in this region, which appears to have been due to a combination of the previous year's record sea ice retreat and a lack of subsequent transport of multiyear ice into the Beaufort Sea during winter 2012-2013. Negligible multiyear ice transport into the Beaufort Sea continued during summer 2013. Nor did multiyear ice drift into Siberian Arctic waters, which is also very rare. Multiyear ice remained confined to the region north of Greenland and northernmost Canada during 2013.

Ice Thickness

The key state variable for the Arctic sea ice cover is ice thickness. In recent years, ice thickness has been estimated over limited regions by aircraft, e.g., the NASA Operation IceBridge (Richter-Menge and Farrell 2013), and over large regions by satellite. The CryoSat-2 satellite, operated since 2011 by the European Space Agency, measures ice freeboard, the height of ice floes above the water line. Preliminary analysis indicates that the Cryosat-2 freeboard estimates are comparable to *in situ* field measurements, with a level of uncertainty that is comparable to other airborne and satellite-based observations. A more detailed error analysis of the freeboard estimates is currently in progress. Calculation of the actual sea-ice thickness from freeboard requires knowledge of snow depth, but in general higher freeboard indicates thicker sea ice. Therefore, freeboard maps in spring in the period from 2011 to 2013 are a proxy for sea ice thickness at the time of maximum ice extent (**Fig. 22**). During the three years of observation by Cryosat-2, the average freeboard has decreased by 0.04 m, from 0.23 m in 2011 to 0.19 m in 2013 (Laxon et al. 2013). Assuming no significant change in snow depth, the decline in freeboard amounts to a mean sea ice thinning of 0.32 m, from 2.26 m in 2011 to 1.94 m in 2013. As with the ice age maps (**Fig. 21**), the Cryosat-2 freeboard maps indicate that most of the thickest and oldest ice occurs to the north of Greenland and northernmost Canada, and it is a small proportion of the total sea ice cover at the end of winter (**Fig. 22**).

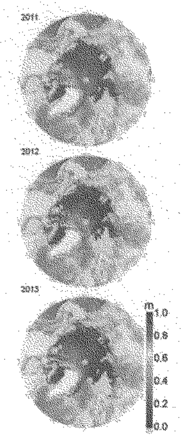

Fig. 22. Ice freeboard (in meters) estimates from Cryosat-2 in March 2011, 2012 and 2013.

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The Center For
Regulatory Solutions

Statement by Karen Kerrigan

President and CEO, Small Business & Entrepreneurship Council

On Behalf of the Center for Regulatory Solutions

Senate Committee on Environment and Public Works

Review of the President's Climate Action Plan

January 16, 2014

President Obama's Climate Action Plan (CAP) is a hodgepodge of policies that will raise energy costs and erode the competitiveness of America's most innovative small businesses and entrepreneurial firms. Its core policies will result in a massive new tax that, over time, will cripple the ability of these enterprising entities' to invest, create new economic opportunities for new labor force entrants or the jobless, and revive the stagnant economy.

The centerpiece of the President's plan is new federal mandates to address carbon dioxide emissions from power plants. In an analysis of these and other EPA regulations conducted on behalf of the National Association of Manufacturers, NDP Consulting found that, "One immediate and incontrovertible impact of these new regulations would be an increase in electricity prices." NDP also concluded, "As consumers of more than 28 percent of electricity production, manufacturers in the United States would see production costs rise." That would lead, NDP noted, "to higher prices of manufactured goods and services, resulting in lost sales at home and abroad, which, subsequently, would encourage layoffs and discourage new hiring and investment, render exports less competitive and ultimately suppress U.S. GDP."

Higher electricity prices will impose particularly severe economic hardship on small business owners, as electricity costs constitute the biggest expense of many small firms. Consider Bob Farber, president of Quality Perforating Inc., a manufacturer of pierced coils, sheets and components, in Scranton, PA. In a May 25, 2010, article in the Scranton *Times-Tribune*, Farber observed, "For a business like ours, electricity is probably our biggest fixed cost because all our machines are electric." Small business owner Todd Westby expressed similar concern in the *International Business Times*: "Electricity prices are a big concern for me. And on a tight budget, I can only account for so much to go toward the electricity bill before I have to pass this cost onto my customers."

The skepticism and opposition to the President's climate policies stretches across the political spectrum as lawmakers from both parties are expressing growing concern and frustration with the Obama Administration's climate mandates. Sen. Joe Donnelly (D-Ind.) has characterized EPA's climate rulemakings as "extreme," for they "fail to recognize the impact these regulations will have on Hoosier families and businesses." Sen. Joe Manchin (D-W.Va.) has pledged to fight, in his words, EPA's "overreach," or the demand that the coal industry "meet impossible standards," something that, Manchin believes, "makes absolutely no sense and will have devastating impacts to the coal industry and our economy." And Sen. Heidi Heitkamp (D-ND) has said she explained to EPA "how these regulations are completely unachievable based on current technology and are cost prohibitive."

As numerous commentators have noted, and as Heitkamp, Manchin, and Donnelly have alluded, EPA's proposal to address carbon dioxide from new power plants (called "New Source Performance Standards") would effectively ban construction of new coal-fired power plants. Cecil Roberts, President of the United Mine Workers, declared bluntly, "That's just a fact." For this reason, Rep. Bill Enyart (D-Ill.) is opposed to EPA's new source rulemaking. "I've spoken to coal operators and Illinois industry leaders in the last week, and it's clear to me that the proposed standards would make it virtually impossible to construct a new coal-fired power plant in America."

EPA counters that coal plants can be built if they use carbon capture and storage technology (CCS) and that by forcing this requirement it will be widely deployed. But CCS is nowhere near widespread commercial viability. Engineering consultant Edward Cichanowicz, who has over 40 years of experience in testing and demonstrating fossil fuel technologies, testified to the House Energy and Commerce Committee that, "I believe that we do not yet have sufficient experience by which to judge the commercial prospects of CCS."

Pursuant to the President's CAP, EPA is also moving forward to control CO2 emissions from existing power plants—a policy that, while in its early stages of development, will surely be designed to force more coal plants to close. In a white paper sent to EPA Administrator Gina McCarthy last year, 18 state attorneys general expressed alarm that, in the existing source rulemaking, "EPA may attempt to force coal-fueled EGUs to decrease operation time or retire early, or force utilities to rely more heavily on natural gas and other resources in an effort to ensure greater CO2 emission reductions."

As it implements the President's radical climate change agenda, EPA's climate rulemakings are effectively forcing through regulatory fiat a misguided energy policy that poses a grave threat to business growth and expansion – and even the survivability of many firms. Simply put, these rules will take affordable energy offline for businesses and replace it with costlier and less reliable sources.

These costs have severe consequences for business owners, so the question arises as to the benefits produced. EPA Administrator McCarthy pledged that the agency's carbon rulemakings will "protect the health of our families and future generations." But the EPA has admitted its proposed rule for new power plants "will result in negligible CO2 emissions changes" by 2022. And McCarthy herself has said that unilateral action to address global climate change will have minimal effect. As she told the House Energy and Commerce Committee, "I think what you're asking is can EPA in and of itself solve the problems of climate change. No we cannot." The International Brotherhood of Boilermakers put it best: "The unilateral destruction of the American coal industry will not solve global climate change."

One of the most troubling aspects of the President's climate agenda is the Administration's attempt to arbitrarily inflate the benefits of its global warming rulemakings. In a secretive process, several agencies dubbed the "Interagency Working Group" established a highly speculative cost estimate called the "Social Cost of Carbon" (SCC) to measure the benefits of reducing carbon emissions. The IWG defines the SCC as "an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year." It is intended to include (but is not limited to) "changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services due to climate change."

The Administration's SCC is based on flawed modeling and mistaken economics. The projections about future damages from climate change are highly speculative. The so-called "Integrated Assessment Models" on which these projections are based have, to quote Professor Robert Pindyck of MIT, "crucial flaws that make them close to useless as tools for policy analysis." And these models were not subject to appropriate peer-review as required by the Office of Management and Budget (OMB).

The process used to calculate the SCC remains shrouded in secrecy and fails to live up the President's claims that he would oversee "the most transparent Administration in history," as well as transparency requirements established by OMB. According to a petition filed last fall by a coalition of business groups, OMB "has not revealed the identity of the participants or any information from which to make an assessment as to the participants' expertise or their qualification to participate in a group tasked to estimate the SCC."

"The public does not even know," the groups contend, "whether all the IWG's listed agencies and entities provided personnel or what levels of engagement each of the agencies actually had in the development of the SCC Estimate. The public does not know whether or how government contractors were used in the development process."

Whether it's bureaucratic secrecy, higher energy costs, flawed economics, or the prospect of fewer jobs, shuttered firms or lost opportunities, there are plenty of reasons why America's small business owners and entrepreneurs oppose the President's Climate Action Plan. It's time for the President to change course and pursue a different strategy, one that encourages domestic energy production and investment in new technologies that will help drive efficiency and innovation. And he should enact policies that support private enterprise, entrepreneurship, and improve the capacity of America's businesses to compete in the global marketplace.

For more than twenty years, the Small Business & Entrepreneurship Council (SBE Council) – a nonprofit advocacy, research and education organization – has worked to protect small business and promote entrepreneurship. The Center for Regulatory Solutions is a project of SBE Council.

U.S. House of Representatives Committee on Science, Space, and Technology Subcommittees on Environment and Energy

EPA Power Plant Regulations:

Is the Technology Ready?

Oct 29, 2013 10:00 a.m.

The Honorable Charles D. McConnell
Executive Director, Energy and Environment Initiative (e2i)
Rice University

RICE

Thank you for the opportunity to address this very important topic.

Carbon Capture and Storage as well as Carbon Capture Utilization and Storage (CCS/CCUS) are critically important to our nation, and I am glad Members of Congress are taking the time to understand the state of today's technology. CCUS is both an environmental solution and an important component of a business strategy. It is a business strategy that allows companies to meet EPA greenhouse gas (GHG) regulations, increase domestic oil production, and create domestic jobs by means of CO_2-EOR. CCUS also is necessary to assure a diversified domestic energy portfolio for energy security. It also helps minimize future rapid escalations in electricity prices, allowing a real "All of the Above" energy portfolio that includes our most abundant domestic resources – clean fossil energy from coal, oil, and natural gas.

Studies have verified that implementation of CCUS technology is necessary to comply with EPA's proposed New Source Performance Standard (NSPS) regulation and meet the GHG targets necessary for limiting CO_2 emissions to our atmosphere. However, commercial CCUS technology currently is not available to meet EPA's proposed rule. The cost of current CO_2 capture technology is much too high to be commercially viable and places the technology at similar economic thresholds of alternative clean, carbon-free energy alternatives currently being subsidized.

CCUS is also necessary to achieve President Obama's June 25th Climate Action Plan, a comprehensive program of domestic GHG emission reductions, adaptation measures, and international activities to address climate change. Global climate change, as the name indicates, must be addressed globally in order to make a difference. The world is and will remain dependent on fossil fuels for many decades to come to provide low cost, readily available and reliable energy.

The President's Plan can only be achieved through the broad global deployment of low cost, commercially viable technology for capturing and permanently and safely storing/utilizing CO_2 from all fossil energy sources. Technology exists for separation and capture of CO_2 at the plant, but it increases the cost of generated electricity by about 80%. CO_2 pipeline technology is mature, but can face siting issues. While injection of CO_2 into deep geologic storage formations is being evaluated, it has only been done successfully on a relatively small scale at a few sites around the globe. And the Department of Energy's (DOE) Regional Carbon Sequestration Partnerships are still developing the needed data base to help analyze the success of its deployment. Saline injection also faces regulatory barriers, such as liability for leakage extending 50 years beyond the time injection ceases, and unresolved property rights issues. CO_2 injection into oil bearing geologies for Enhanced Oil Recovery (EOR) has been practiced safely for over 50 years. Although the geologies are known to have permanence for storage, the long-term measurement, monitoring, and verification of these geologies has not been practiced for CO_2 storage.

DOE, in partnership with industry, is pursuing a research, development, and demonstration (RD&D) program to address all of these issues, especially CO_2 capture cost reduction, but affordable solutions may be decades away with the current level of funding and resultant R&D strategy. Moreover, the timing of retirement of existing coal-fired units, based on age and regulatory pressures, and the modest amount of new domestic power plant capacity resulting in part from the weak economic recovery, could lead to further delays in commercializing this necessary technology in our country. Internationally, however, the drive to provide electricity to those in developing nations is in full force and the year-over-year demand for coal globally is up 20% due to the pressure to eliminate energy poverty.

The DOE's coal research and development funding levels must be increased to enable the pursuit of demonstration projects to move transformational, low cost CCUS technology from the laboratory to the commercial marketplace in a timely manner. The sequester and persistently low budget request numbers have resulted in cuts to coal R&D at rates significantly lower than other DOE programs. An additional $100 million per year directed at low-cost, transformational CCUS could enable the demonstration of commercially viable CO_2 capture technology within ten years. While a considerable amount of technical risk would be required to undertake a program with this short of a schedule, it can be done.

Such risk could be made manageable through the build-out of DOE's extensive scientific and engineering CCUS database, along with the scaling and system integration experience provided by the major CCS demonstration projects – such as the Kemper Project, scheduled to go on line in 2014.

These demonstration projects were funded with stimulus dollars. However, the stimulus dollars were focused on near term jobs creation and had associated "sunset clauses" not typically part of demonstration program funding. Sunset clauses force the demonstration of first of kind technologies on an "artificial" legislated schedule – not a schedule determined by the management of risks associated with the scaling and integration of complex new technologies and the acquisition of financing for multi-billion dollar first-of-a-kind plants. While a large amount of stimulus monies were provided, they were sufficient to cover only about 20% or less of the costs of many of the major fossil/CCS/CCUS power plant demonstration projects. This required DOE's project partners to acquire billions of dollars in financing for technically and financially risky projects during a period that the U.S. was going through a deep recession – not easily done. This takes much time and effort to accomplish. The stimulus funding sunset provisions scheduled for September 2015 allow for very little time to secure such financing and many good projects could be lost as a result. The Congress may wish to consider extending the sunset provisions and also allowing DOE to transfer stimulus funding between ongoing projects to maximize success.

It is obvious that there is a need for continued funding as is defined by technologies that are not deemed to be "commercially available." To summarize, in my opinion, it is disingenuous to state that the technology is "ready" and it is wrong to underfund to assure failure if the true goal is "All of the Above."

June 25, 2012

Via Electronic Submission & First Class Mail

EPA Docket Center
U.S. EPA
Mail Code: 2822T
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Attn: Docket ID No. EPA-HQ-OAR-2011-0660

RE: Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources:
Electric Utility Generating Units, Proposed Rule, 77 Fed. Reg. 22392
Docket ID No. EPA-HQ-OAR-2011-06660

Dear Sir or Madam:

San Miguel Electric Cooperative, Inc. respectfully submits the following comments on the Environmental Protection Agency's ("EPA" or "agency") proposed rule: Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units.

The principal business of San Miguel Electric Cooperative, Inc. (hereinafter referred to as San Miguel) is the production of electric energy in South Central Texas. Production includes one (1) lignite-fired power plant and one (1) lignite mine in South Central Texas. This lignite-fired power plant has a net capacity of 391 Megawatts and is a base load unit. The generating unit fires only lignite provided by the lignite mine. This one lignite-fired unit comprises 100% of SMEC's generating capacity and average yearly output is 2.9 million megawatt hours.

Although this proposed rule effects new electric generating stations and does not effect San Miguel's existing electric generating unit, San Miguel has a significant interest in the outcome of this rulemaking. San Miguel's lignite fired electric generating facility is a major source of electrical generation to our member cooperatives, under a long-term wholesale power contracts for 100% of the generation of the San Miguel Generating Station. Being not-for-profit, San Miguel will be forced to pass along, to its consumer-owners, all costs of meeting any new requirements that may result from the implementation of Greenhouse Gas Emissions (GHG).

As a member-owned electricity supplier, San Miguel understands that reliable, affordable electricity has been one of the key drivers of economic growth and prosperity in this country. This fact must not be forgotten as the EPA makes decisions on whether and how to regulate electric generating unit emissions under this and future potential rulemakings.

San Miguel is a member of the National Rural Electric Cooperative Association (NRECA) and the Gulf Coast Lignite Coalition (GCLC) and supports comments filed those organization.

Overview

San Miguel comments will cover the following topics:

- **NSPS requirements for coal and lignite units should be placed in a separate category (and furthermore subcategorized based on fuel rank) from natural gas combined cycle units**
- **Carbon Capture and Sequestration (CCS) is not a commercially available technology**
- **Proposed emission limit is output based but should be input based due to inefficiency of units operating below design point, at high elevations, or equipment malfunctions**
- **"Field of Dreams" compliance option of providing higher emission limits for coal plants coupled with eventual carbon mitigation to average the proposed 1,000 lb standard over 30 years.**
- **EPA must state its support for the Pollution Control Project exemption from triggering "new source" requirements and clearly outline in the regulation text that Prevention of Significant Determination permitting requirements are not triggered by this rule.**

1) NSPS requirements for coal and lignite units should be placed in a separate category (and furthermore subcategorized based on fuel rank) from natural gas combined cycle units.

Over the entire history of the CAA, EPA has never set a single NSPS for all power plants based on an emission rate achievable by only one type of fuel with the lowest emissions rate. It would simply make no policy or economic sense, and it would be a violation of CAA § 111(b)(5), which states that:

> nothing in this section shall be construed to require, or to authorize the Administrator to require, any new or modified source to install and operate any particular technology system of continuous emission reduction to comply with any new source standard of performance.

Due to the unavailability of commercially proven and economically viable CCS technology for coal- and lignite-fired power plants, EPA actually goes beyond requiring a specific technology system and dictates an entire change in fuel.

EPA, only months ago, affirmed that it is inappropriate to apply performance standards based on natural gas on coal-fired EGUs, stating in its Response to Public comment accompanying the final Mercury Air Toxic Standards that:

> "... basing the[se] standards on [natural gas or distillate oil] would result in standards that are neither technically nor economically achievable for coal-fired EGUs. Basing the amended standards on the use of natural gas would preclude the development of new coal-fired EGUs since the standards would not be technically achievable...Therefore, basing the NSPS on [natural gas] emissions would not be achievable for coal-fired EGUs

> with any technology that EPA is aware of. If the NSPS were to essentially prohibit the construction of new coal-fired EGUs, the regulated community might stop development of promising control technologies, including carbon capture and storage, which can be used on existing coal-fired EGUs in addition to new coal-fired EGUs."

Natural Gas Combined Cycle (NGCC) is not a " control technology" for the purposes of the CAA nor is it the "best system of emission reduction" for coal, lignite, or other non-natural gas sources of fuel. To state otherwise ultimately leads to absurd results. Under this argument, nuclear power could be advocated as the "best system of emission reduction" for power production. While this may be a step farther than EPA has taken, EPA has still taken a very long step in the same direction and with the same results. To draft a rule with only this single category, based on an NGCC standard of performance, usurps this CAA purpose and history, and replaces it with the implementation of forced fuel switching.

To compare natural gas combined cycle power plants to coal power plants is like comparing apples to oranges. Similar to the way that apples and oranges are both fruit that provide sustenance, coal and gas power plants may both be fossil-fuel powered and may often meet base load electricity demand, but beyond that, they are very different.

2) Carbon Capture and Sequestration (CCS) is not a commercially available technology
EPA states that CCS is technologically achievable and can be considered as part of its NSPS analysis.

CCS has never been implemented commercially at a full-scale at functioning power plants, and to the extent it has been implemented (or is in the process of being implemented) at experimental and demonstration units, it has only been undertaken with the support of extensive federal subsidies and other non-private funding. The Clean Coal Power Initiative ("CCPI") was created by the Energy Policy Act of 2005 ("EPACT") to provide hundreds of millions of dollars of federal funding to clean coal projects. However, understanding that technologies developed under this act would not be commercially available, Congress included limitations on using these technologies as part of NSPS or other CAA reviews, stating that:

> No technology, or level of emission reduction, solely by reason of the use of the technology, or the achievement of the emission reduction, by 1 or more facilities receiving assistance under this Act, shall be considered to be—
>
> (1) adequately demonstrated for purposes of section 111 of the Clean Air Act (42 U.S.C. 7411);
> (2) achievable for purposes of section 169 of that Act (42 U.S.C. 7479); or
> (3) achievable in practice for purposes of section 171 of that Act (42 U.S.C. 7501).

Similarly, the Clean Air Program, modified by the Energy Policy Act of 2005 ("EPACT") included the provision that:

> No technology, or level of emission reduction, shall be treated as adequately demonstrated for purpose of section 111 of the Clean

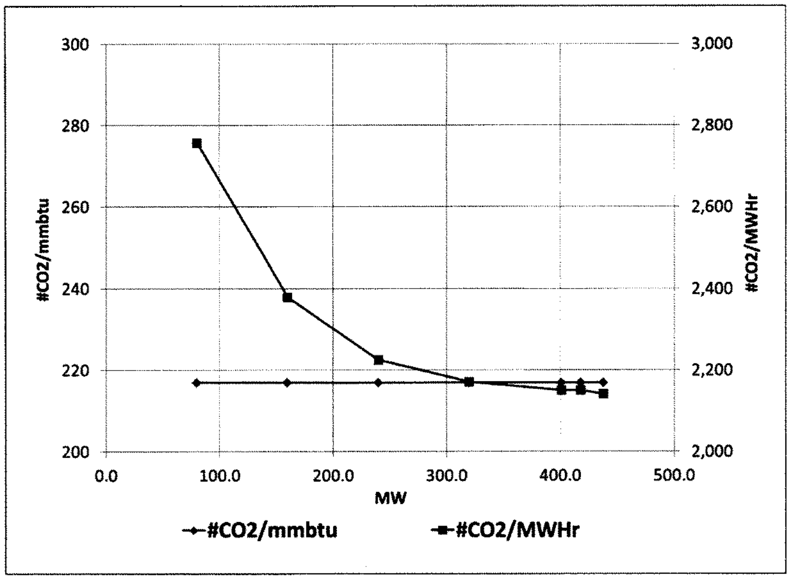
> Air Act (42 U.S.C. 7411), achievable for purposes of section 169 of that Act (42 U.S.C. 7479), or achievable in practice for purposes of section 171 of that Act (42 U.S.C. 7501) solely by reason of the use of such technology, or the achievement of such emission reduction, by one or more facilities receiving assistance under section 3102(a)(1).

In order for CCS to become commercially available, numerous other obstacles must also be overcome. Technically, there are still significant concerns regarding operating costs including energy consumption requirements as well as the size of the equipment – potentially doubling the size of the power plant footprint. The captured carbon must also be transported and stored somewhere, and reserve locations, availability, and capacity have still not been adequately determined. Legal challenges include the acquisition and ownership of pore space and other issues regarding the regulation of carbon transportation and stewardship of the stored CO2.

There is potentially a future in CCS technology, but at this point, it is still the future. CCS is still not close to the level where it can be available, warrantable, insurable, and fundable in the open market.

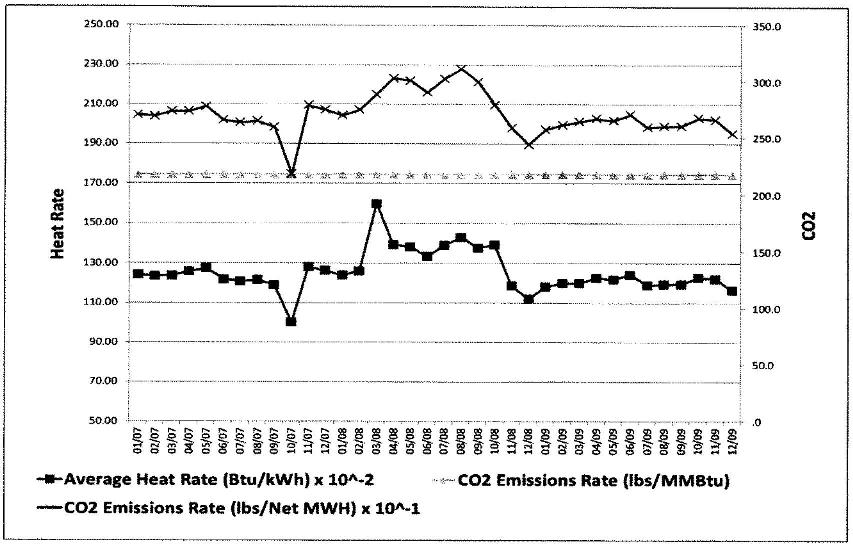
3) Proposed emission limit is output based but should be input based due to inefficiency of units operating below design point, at high elevations, or equipment malfunctions.

An output derived standard such as a CO2/Mwh metric cannot realistically be applied to EGUs without accounting for significant and unavoidable variability's. This is the case because an EGU heat rate and thus the CO2/Mwh rate vary significantly over the EGU operating range and the duty-cycle to which the unit is committed. The following graph shows how CO2/mmBtu and CO2/Mwh varies with load at the San Miguel generating unit. Note how CO2/Mwh increases at lower loads while CO2/mmBtu remains relatively constant.



Graph based on turbine design heat rate and design boiler efficiency

Moreover, an EGU heat rate characteristic and thus the corresponding CO2/Mwh rates are largely unit specific, and they can be severely impacted by equipment conditions which cannot be quickly or easily remedied. The graph below shows how increased heat rate in 2008, due to a steam turbine mechanical problem. The problem was diagnosed but the unit could not be taken off line during the summer season so it was required to run with the higher heat rate until the lower energy demand season in the fall.



The proposed 1000 Lb. limit applicable to NGCC is too stringent in practice. EPA requests comment on the standard ranging from 950 Lb. to 1100 Lb standard, 77 Fed. Reg. at 22406. EPA fails to discern as a matter combustion theory that fossil fired generating units including NGCC units located at higher altitudes utilizing thinner air are inherently less efficient, thus these units simply cannot match efficiency levels of similar units located at lower elevations.

Moreover, according to a recent analysis conducted by the University of California examining the viability of the 1000 lb standard, if EPA would have considered several major additional factors in determining the proposed standard, it would have resulted in a different proposed standard.[1] First, EPA apparently relied only on EGU heat rate data to determine an appropriate standard. If, however, EPA would have examined continuous emissions monitoring systems (CEMS) data, it would have concluded that only 84% of the units first operating between 2006 and 2010 could meet the 1000 Lb standard, not 95% as EPA reported.[2]

> Second, as this study recognizes, the larger the NGCC units operating at higher capacity factors have better efficiencies. [3] As NGCC units increase their presence within the industry assuming more baseload and intermediate load functions, NGCC units will vary more in size and in usage on a capacity factor basis making the proposed 1000 lb

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[1] How Stringent is EPA's Proposed Carbon Pollution for New Power Plants? P.9 (April 2012) available at www.uce3.berkeley.edu

[2] Id.

[3] Id.

standard as a practical matter unachievable by more and more NGCC units. Clearly EPA should reexamine the proposed standards and adjust upward to ensure new units can achieve the NSPS considering varying unit size and utilization so the NSPS can be achieved in practice.

4) "Field of Dreams" compliance option of providing higher emission limits for coal plants coupled with eventual carbon mitigation to average the proposed 1000 lb standard over 30 years.

Section 111(a) (1) of the CAA defines NSPS as the best system of emission reduction (BSER) adequately demonstrated. In application this means for NSPS, a BSER must be commercially available for any new source within the industrial category located anywhere throughout the country for which the standard applies. EPA concludes that BSER for coal-fired generation is not based on CCS, but takes the position that CCS is "feasible and sufficiently available," 77 Fed. Reg. at 22,418. Although there is no BSER for coal used as a fuel that meets the proposed 1000 lb CO2/Mwh NSPS that is commercially available, EPA appears to offer a "compliance alternative" that sets a current 1800 lb CO2/Mwh NSPS for coal coupled with the eventual requirement for carbon mitigation to average the proposed 1000 lb standard over 30 years. This reminds me of the movie "Field of Dreams" where the premise is - if you build it they will come. In this compliance option EPA is saying if we make a rule somebody will make it happen, even though it has not been proven commercially feasible. The reality is this alternative requires a present obligation to commitment to using a CCS technology not commercially available. EPA has no discretion under the NSPS provisions or the CAA as a whole to promulgate future requirement to use a technology that is not presently viable.

5) EPA must state its support for the Pollution Control Project exemption from triggering "new source" requirements and clearly outline in the regulation text that Prevention of Significant Determination permitting requirements are not triggered by this rule.

EPA repeats throughout this proposal that this rule will add certainty for operators looking to build new coal units, including that "this rulemaking eliminates uncertainty about the status of new coal and may well enhance the prospects for new coal-fired generation."[4] GCLC believes that any "certainty" that the rule, as proposed with the combined category, brings is that it will be extremely difficult, if not impossible, for a new coal- or lignite-fired power plant to be constructed. GCLC is particularly concerned with the Rule Proposal's potential impact on existing, modified, and reconstructed units.

EPA relies on the PCP exemption, codified at 40 CFR §§ 60.2 and 60.14(e), to diminish the potential impact of this rule on existing power plants. These provisions include that changes made to a power plant associated with the installation of pollution control projects will not trigger the other requirements of the rule. GCLC strongly supports this exemption and believes it is the only rational and practical implementation of the overlapping requirements of the CAA. However, due to recent court decisions, as noted by EPA, there may be some uncertainty whether this provision may continue. Instead of simply requesting comments on the continued validity of the PCP Exemption, EPA itself must affirmatively support the PCP Exemption in the final version of this rule or risk jeopardizing the largest source of United States domestic power. There is also lingering uncertainty whether this rulemaking will trigger Prevention of Significant Deterioration ("PSD") program obligations. EPA, in this Rule Proposal's preamble, stated that language in the EPA's Tailoring Rule preamble made it clear that EPA did not intend to trigger PSD for CO2 emissions.[5] Therefore, "EPA's position is that the Tailoring Rule thresholds continue to apply even when the EPA promulgates the first NSPS for GHGs."[6] EPA also added that it is "proposing to revise the NSPS regulations...to explicitly make clear that the NSPS trigger provision in the PSD regulations incorporate the Tailoring Rule thresholds."[7] The proposed language to be codified in 40 CFR Part 60 does not appear to include this provision, and instead of relying on preamble language (which is secondary to codified language), EPA must explicitly include such language in the actual rule language to be codified in the CFR.

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[4] GHG NSPS Rule Proposal at 22399.

Conclusion

This proposed rule virtually kills the future of any new coal fired electric generating units being built and replaces it with NGCC generating units. Coal has been the backbone of providing economic and reliable electric power in the United States for over 50 years. While on the other hand, natural gas has a history of extremes in availability and price volatility. In the 1970's gas companies would not provide new hook ups to homes. In the summer of 2000 gas prices in the west hit prices of $12 -15 per million Btu and there were rolling blackouts in California. The United States has one of the largest coal reserves in the world, are we willing to sterilize this energy source and retire a stable coal mining industry for the volatility of natural gas, especially in this economically challenged time? SMEC believes a stable generating system should consist of a portfolio of coal, gas, hydro, nuclear and renewables. This proposed rule will eventually delete coal from that mix and since the other large generating source, nuclear plants, have not been built for two decades only one fuel source remains for new generation – natural gas. This would not be a diverse portfolio that can withstand variations in gas availability or costs. SMEC requests the EPA reconsider this proposal and establish reasonable GHG emission standards for new coal fired generating units (including a subcategory for lignite) that can be met with existing control technologies that are commercially available.

If you have any questions concerning these comments please contact me.

Sincerely,

Joseph G. Eutizi
Engineering Manager
San Miguel Electric Cooperative, Inc.

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[5] *Id.* at 22429.

[6] *Id.*

[7] *Id.*

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SNLEnergy DAILY COAL REPORT
Volume 8 Issue 7 **Monday, January 13, 2014**

Coal equities teed up to take advantage of improving coal market fundamentals

by Everett Wheeler

Coal equities stand to benefit from improving market fundamentals, according to a Jan. 9 Sterne Agee report.

"Generally, we believe coal companies have accomplished three important goals during 2013 — reduced operating costs, lowered capital expenditures and recapitalized balance sheets to lengthen maturities and enhance access to liquidity," Sterne Agee analyst Michael Dudas wrote. "Now, we believe the equities are positioned to await some more positive news from the markets served."

Dudas wrote that domestic thermal coal markets appear "more resilient" than metallurgical coal markets: "We have raised our domestic thermal and lowered our global met benchmark expectations for 2014; we expect increases in each during 2015."

The firm expects CONSOL Energy Inc. and Arch Coal Inc. will benefit from thermal market recovery, while Peabody Energy Corp. and Alpha Natural Resources Inc. will take advantage of global economic recovery trends.

"We expect the group to benefit from potential natural gas pricing improvements and investors positioning for cyclical exposure during 2014," the report said.

Continued on p 11

SNL Daily OTC Coal and Emissions Assessments

Jan 10, 14 Product	Price ($/ton)	Change (%) 1 day	 1 week
NYMEX Big Sandy			
February 2014	57.25	-0.23	0.09
Q2 2014	56.93	-0.65	-0.78
CSX/Rail			
February 2014	66.25	0.41	1.92
Q2 2014	66.40	2.87	2.47
PRB 8,800			
February 2014	11.55	0.00	-2.12
Q2 2014	12.15	-0.25	0.58
PRB 8,400			
February 2014	9.85	0.00	-3.90
Q2 2014	9.85	-0.51	-3.43

Jan 10, 14 Product	Price ($/credit)	Change (%) 1 day	 1 week
SO2			
2009	1.34	0.00	0.00
2010	0.63	0.00	0.00
2011	0.63	0.00	0.00
2012	0.63	0.00	0.00
2013	0.64	0.00	18.52
2014	0.58	0.00	0.00
2015	0.53	0.00	0.00
NOx			
2013	16.50	0.00	-62.50
2013	16.50	0.00	0.00

Data provided by Evolution Markets and Amerex Brokers

White House highly critical of EPA's carbon capture mandate in interagency review

by Jonathan Crawford

The White House's Office of Management and Budget appears to have raised considerable doubts about the U.S. EPA's basis for mandating the installation of carbon capture and storage, or CCS, technology on new coal plants in its proposed greenhouse gas rule, according to interagency communications that were made publicly available Jan. 8.

The OMB, the agency tasked with reviewing rules prior to finalization, had said the EPA's heavy reliance on literature reviews, pilot projects and facilities under construction "cannot form the basis of a finding that CCS on commercial-scale power plants is 'adequately demonstrated.'"

Noting that CCS "has not been deployed at scale in commercial power plants," the OMB maintained that the EPA's assertions that CCS technology is adequately demonstrated, as required under the Clean Air Act, is "unsupported." In light of the limited deployment of CCS, the OMB called on the EPA to

Continued on p 10

Whitfield, Manchin introduce bill to block carbon rules

by Taylor Kuykendall

Two coalfield legislators are pushing bills in the U.S. House and Senate to provide a "reasonable alternative" to the U.S. EPA's proposed carbon standards for new power plants and planned regulation of existing power plants.

Rep. Ed Whitfield, R-Ky., and Sen. Joe Manchin, D-W.Va., say the Electricity Security and Affordability Act would require greenhouse gas standards from the EPA to be achievable with existing, commercially proven technology and allow Congress to set the effective date of greenhouse gas regulations on existing plants.

Whitfield unveiled a draft of his bill, H.R. 3826, in October 2013. Manchin will introduce a companion bill in the Senate.

For new plants, the bill would establish separate standards for natural gas and coal-fired plants, set standards for the coal category that have been achieved over a one-year period by at least six coal-fired units at different commercial power plants in the

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U.S., and establish a different subcategory for lignite coal-fired power plants.

The bill would repeal the EPA's prior proposed rules to establish greenhouse gas emissions standards for new power plants.

For existing power plants, "any rule establishing GHG standards or guidelines applicable to modified, reconstructed, or existing plants shall not take effect unless a federal law is enacted specifying the effective date," the bill says.

In the case of a proposed rule for existing power plants, the EPA would have to submit a report to Congress on its economic impacts and the projected effects on global greenhouse gas emissions.

"This bipartisan, bicameral solution will allow coal to continue to supply affordable, reliable electricity necessary to support a growing economy," Whitfield said. "It will hold EPA accountable by ensuring that greenhouse gas regulations for power plants moving forward are actually achievable and preserve an 'all-of-the-above' energy strategy."

Manchin said he wants to "strike a balance between a healthy environment and a healthy economy."

"It's time to invest in a diverse energy portfolio that includes coal, natural gas, nuclear, renewables and oil," he said.

The Energy and Power Subcommittee, chaired by Whitfield, will vote on the legislation Jan. 13.

The U.S. Chamber of Commerce has supported the bill. Most recently, on Jan. 9, the National Mining Association endorsed it.

Industry Document: Whitfield and Manchin Introduce Bipartisan Electricity Security and Affordability Act

Read this article on SNL web.

US senators press Interior nominee on OSM oversight, stream rule snafu

by Bill Reilly

Four U.S. coal-state senators have sent a letter to Janice Schneider, the nominee to be Assistant Secretary for Land and Management at the U.S. Department of the Interior, about the Office of Surface Mining Reclamation and Enforcement and its change of mind about how to assess the environmental and regulatory impacts of a stream "protection" rule.

Sens. Joe Manchin, D-W.Va.; Rob Portman, R-Ohio; John Barrasso, R-Wyo.; and Mike Lee, R-Utah, urged Schneider "to promptly address a report that poses serious questions about the integrity" of the OSM. That report, released Dec. 20, 2013, by the Interior Department's Office of Inspector General, found that officials within the OSM had asked a subcontractor to change the baseline for assessing the impacts of rewriting the Bush-era 2008 stream "buffer zone" rule.

"We are especially concerned with OSM's decision to reverse its position on how to estimate job losses expected to result from its proposed stream rule," the senators wrote in the Jan. 8 letter.

"OSM should abide by its original position on how to estimate job losses expected to result from its proposed stream rule and we will only be able to support a nominee who shares this view. Specifically, we will need your commitment that, if confirmed, you will direct OSM and any contractors to estimate job losses by acknowledging that the proposed stream rule would replace the 1983 stream rule — not the 2008 stream rule — in states other than Tennessee and Washington."

In doing a regulatory impact analysis, the OSM had compared coal production and jobs under the pending rewrite and a Reagan-era 1983 rule. The analysis showed a loss of 7,000 jobs from a rewrite, a number that was leaked to the press in January 2011. The OSM then directed the contractor to use for comparison purposes the 2008 rule, which is on the books but has been implemented in only two states because it is still being litigated. The change had the effect of reducing projected job losses around the time that the Obama administration was pushing job creation.

The controversy was the subject of an oversight hearing before the House Natural Resources Committee on Jan. 9. The Interior Department is in the process of reviewing the OIG report.

If confirmed, Schneider would have direct oversight of OSM.

The senators requested her commitment to ensure that agencies subject to her oversight "will estimate job losses from any ongoing or future rulemakings by assessing the impacts that would take place if the new rule replaced a rule currently — not hypothetically — in effect. We believe our requests are reasonable and, if granted, will only help to restore the public's confidence in DOI's rulemaking process."

Industry Document: Manchin, Portman, Barrasso, Lee Call on Interior Nominee to Denounce Politically Motivated Jobs Statistics

Read this article on SNL web.

Duke sees Crystal River coal plant as 'most cost-effective' option in Florida

by Matthew Bandyk

Duke Energy Corp. is moving ahead with plans to keep coal generation online at its Crystal River plant in Citrus County, Fla., for an extra two years by burning a special kind of lower-emissions coal, a goal that will likely trigger a regulatory fight with the Sierra Club.

While it is retiring the nuclear plant at the site on the Gulf of Mexico, Duke's Florida utility is trying to preserve the coal-fired units 1 and 2 at Crystal River through 2018. That is the year Florida's rules to implement federal standards for regional haze will force Crystal River to install $1 billion in pollution controls or cease burning coal.

The cost of the scrubbers needed to comply with the U.S. EPA standards is too much for Duke Energy Florida Inc. to swallow. "These are our two oldest coal units in our fleet so it's not economical for us to put in scrubbers," Duke spokesman Sterling Ivey said Jan. 9, especially considering the fact that the permits for the units expire in 2020.

With a combined nameplate capacity of 964.3 MW, Crystal River 1 and 2 began operating in 1966 and 1969, respectively, according to SNL Energy data.

But Duke believes Crystal River 1 and 2 can comply with another set of EPA rules, the Mercury and Air Toxics Standards, or MATS, at a fraction of the cost of the scrubbers. Complying with MATS by 2016 would give the units an extra two years of life before the need for the scrubbers arrives. The utility hopes to comply by switching Crystal River 1 and 2 to burning lower-sulfur coal that wastested at the units last summer.

Crystal River currently uses coal from Appalachia, such as 347,000 tons from Arch Coal Inc.'s Kentucky River Loading facility in Perry County, Ky., in 2013 through October, according to SNL Energy data. But the relatively cleaner coal would come from Arch Coal's West Elk mine in Colorado. The plant used 110,000 tons from that mine in 2013 through October for the test burn.

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The switch also requires relatively cheap emissions control modifications at each unit: dry sorbent injection systems to control acid gas emissions and activated carbon injection systems to reduce mercury, Ivey said. The cost of using the low-sulfur coal and these modifications is about $28 million in capital costs, with annual operation and maintenance costs of about $2 million, according to a Dec. 31, 2013, filing with the Florida Public Service Commission.

Overall, this plan is $307 million cheaper than the alternative of retiring Crystal River 1 and 2 before the MATS compliance deadline in April 2016 and trying to rely on purchased power to fill the gap, according to Duke's estimate.

"Extending [Crystal River] 1 and 2 is the most cost-effective option for Duke Energy Florida to comply with the new Mercury and Air Toxics Standards regulation as well as reliably serve the energy needs of our customers," Ivey said.

The filing asks the commission to allow Duke to recover the costs of the MATS compliance project from its Florida customers. But the Sierra Club is likely to try to persuade the commission to reject this request.

"Duke Energy is showing their true colors, choosing more air pollution and higher costs for Floridians. By choosing to keep the obsolete and expensive Crystal River coal units running, Duke is committing to two more years of Florida's energy dollars going out of state and is stalling again in building up clean energy solutions like solar power and improving efficiency in the Sunshine State," Sierra Club Beyond Coal Campaign representative Kelly Martin said in an email.

While the environmental group has not filed any formal opposition, "we are reviewing Duke's request and considering all our options," according to spokeswoman Jenna Garland.

Duke hopes to replace the units' power with output from a new 1,640-MW natural gas-fired, combined-cycle plant that is being pursued under a request for proposals process that the utility issued last year. That plant cannot be built at the same site as Crystal River due to infrastructure issues, Ivey said.

Crystal River also has units 4 and 5, two 740-MW coal units that were built in the 1980s. These newer units are already scrubbed and will be operating indefinitely, according to Ivey.

COMPANIES REFERENCED IN THIS ARTICLE:

Arch Coal Inc.	**ACI**
Duke Energy Corp.	**DUK**
Duke Energy Florida Inc.	

Regulatory Filing: Duke Energy Florida Inc.

Read this article on SNL web.

Georgia Power to retire 155-MW coal unit

by Matthew Bandyk

Southern Co.'s Georgia utility plans to retire a 155-MW coal-fired generator at its Mitchell plant, Georgia Power Co. said Jan. 10, adding yet another retirement to the utility's sweeping 2 GW of coal and oil plant closures through 2016.

According to a statement, Georgia Power is asking the Georgia Public Service Commission to approve decertifying unit 3 at Plant Mitchell in order to retire it by April 16, 2015, the date the U.S. EPA will begin enforcing the Mercury and Air Toxics Standards, or MATS, a wide-ranging limit on certain pollutants that has forced thousands of megawatts of older coal-fired plants around the country to shutter.

The move is the final step in a turn of fortune for the plant in Albany, Ga., where just four years ago state regulators had signed off on a plan to keep Mitchell unit 3 running by switching it to a 96-MW biomass-burning generator. But in January 2010, the project was put on hold, with Georgia Power saying it had to wait for the EPA to clarify regulations affecting the proposed conversion.

The biomass project is now off the table. "We just saw costs continue to increase," Georgia Power spokesman Brian Green said Jan. 10. When the Georgia PSC approved the project in 2009, the company estimated the capital costs at $130 million. But by this year, the costs had gone up to $330 million due to delays and changing environmental regulations, according to Green. The utility has spent less than $5.4 million on the project so far.

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Energy Pricing Trends

PEAK ELECTRICITY INDEX (Day Ahead prices for Delivery on Jan 13, 14)

Delivery Point	Volume Wgtd. Average ($/MWh)	Change From Jan 10, 14 ($/MWh)	Volume Wgtd. Average %△		Trade ($/MWh)			Trading Volume (MWh)	All Peak Hours Volume (MWh)
			1 Day	1 Year	Median	Low	High		
MIDWEST									
A.D.	34.75	-0.75	-2.11	25.23	-	-	-	-	-
Indiana	35.75	0.25	0.70	30.00	-	-	-	-	-
Michigan	36.75	3.00	8.89	47.00	-	-	-	-	-
Minnesota	43.00	-3.50	-7.53	53.57	-	-	-	-	-
N. Illinois (CE)	32.25	1.00	3.20	19.44	-	-	-	-	-
NORTHEAST									
NY Zone G	48.75	-21.50	-30.60	33.56	-	-	-	-	-
NY Zone J	49.00	-28.00	-36.36	31.54	-	-	-	-	-
NY Zone A	44.25	-13.50	-23.38	55.26	-	-	-	-	-
Nepool-Mass	50.00	-36.75	-42.36	35.14	50.00	50.00	50.00	50	800
Ontario	39.50	-4.75	-10.73	58.00	-	-	-	-	-
PJM West	36.90	-3.48	-8.62	24.12	36.93	36.75	37.00	200	3,200
OTC BROKER									
Broker ERCOT-Hou.	33.75	1.25	3.85	25.00	-	-	-	-	-
Broker ERCOT-North	33.00	0.50	1.54	22.40	-	-	-	-	-
Broker ERCOT-South	34.00	1.50	4.62	24.77	34.00	34.00	34.00	75	1,200
Broker ERCOT-West	33.50	1.00	3.08	28.85	-	-	-	-	-
SOUTH									
ERCOT-Hou.	33.75	1.25	3.85	25.00	-	-	-	-	-
ERCOT-North	32.85	0.33	1.01	21.76	33.00	32.75	33.00	500	8,000
ERCOT-South	34.00	1.50	4.62	24.77	-	-	-	-	-
ERCOT-West	33.50	1.00	3.08	28.85	-	-	-	-	-
Entergy	31.50	-1.25	-3.82	21.15	-	-	-	-	-
Fla. In-State	36.25	0.25	0.69	16.94	-	-	-	-	-
Fla.-Ga. Bdr.	36.00	-1.25	-3.36	21.01	-	-	-	-	-
Southern	33.75	-1.75	-4.93	22.73	-	-	-	-	-
WEST									
COB	38.50	2.76	7.72	25.53	38.50	38.50	38.50	25	400
Mead	38.25	0.25	0.66	21.43	38.25	38.25	38.25	25	400
Mid-C	34.50	1.50	4.55	17.95	-	-	-	-	-
NP-15	46.25	1.25	2.78	21.71	-	-	-	-	-
Palo Verde	37.50	0.12	0.32	21.24	37.50	37.50	37.50	25	400
SP-15	46.75	3.50	8.09	8.72	-	-	-	-	-

Additional delivery points and other energy pricing information are available at http://www.snl.com/interactivex/marketdata.aspx.

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Stock Highlights

Friday

Company	Ticker	Close	Volume	Total Return %
RANKED BY TOTAL RETURN GAIN				
Cloud Peak Energy	CLD	16.88	1,154,755	1.1
CONSOL Energy	CNX	36.63	2,099,805	1.0
Peabody Energy	BTU	17.55	10,825,633	0.5
RANKED BY TOTAL RETURN LOSS				
Natural Resource	NRP	16.60	4,120,799	-18.4
Alliance Resource	ARLP	75.30	126,020	-2.4
Alliance Hldgs GP	AHGP	55.42	40,183	-1.4

Company	Ticker	Price % Chng	Volume	Volume as % of Avg (1 Year)
VOLUME HIGHLIGHTS				
Natural Resource	NRP	-18.4	4,120,799	1,529.8
Westmoreland Coal	WLB	-0.5	75,485	241.0
Rhino Resource	RNO	-1.3	131,072	217.1

Note: Institutions ranked in the above tables must be traded on a major exchange, have a closing price greater than $3, and daily volume greater than 1,000 shares.

Past Week

Company	Ticker	Close	Volume	Total Return %
RANKED BY TOTAL RETURN GAIN				
Rhino Resource	RNO	12.06	534,621	0.8
Alliance Resource	ARLP	75.30	316,224	-1.3
Alliance Hldgs GP	AHGP	55.42	151,195	-1.6
RANKED BY TOTAL RETURN LOSS				
Natural Resource	NRP	16.60	5,430,383	-16.0
Walter	WLT	13.80	34,719,896	-13.6
Alpha Natural Rsrc	ANR	6.21	72,271,990	-11.8

Company	Ticker	Price % Chng	Volume	Volume as % of Avg (1 Year)
VOLUME HIGHLIGHTS				
Natural Resource	NRP	-16.0	5,430,383	403.2
Westmoreland Coal	WLB	-3.0	399,895	255.3
Rhino Resource	RNO	0.8	534,621	177.1

Note: Institutions ranked in the above tables must be traded on a major exchange, have a closing price greater than $3, and daily volume greater than 1,000 shares.

Daily Index Values

		Percentage Change			
	Value	1 Day	1 Week	YTD	52 Week
Energy	292.4	0.70	0.86	-0.69	11.40
SNL Energy Large Div	168.7	1.50	2.69	0.79	10.38
Energy Sml Dvsfd	293.7	1.07	1.65	0.18	22.21

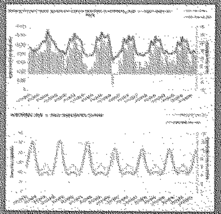
		Percentage Change			
	Value	1 Day	1 Week	YTD	52 Week
Coal	214.5	-1.70	-5.38	-7.14	-11.16
Electric Co	321.5	1.54	2.37	0.67	6.36
Merchant Gen	193.2	0.02	-1.63	-2.34	9.23

Elevate your internal risk processes;
SNL expands forward curves coverage

SNL Energy added 17 new locations to our existing coverage, and now offers 84-month forwards at 47 power hubs, sourced from OTC Global Holdings (OTC GH). With expanded market coverage in PJM, ISO New England, and Canada, the 7-year daily forwards provide a comprehensive, independent market valuation tool to support internal risk processes.

Updated templates reflect the expanded coverage and now offer around the clock calculations for power forwards:

- OTCGH Forward Market Browser shows historical curve evolution to capture converging or diverging forwards
- OTCGH Power Forwards displays single day on-peak, off-peak, and around the clock forwards with an option to view calculated forward spark spreads and implied heat rates



SNLEnergy

Natural Gas and Power Forwards can be found in SNL online's Markets & Deals tab, under Power > Forwards & Futures and Natural Gas > Forwards & Futures.

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To comply with MATS, Georgia Power needed to dramatically cut emissions at Mitchell. Converting from coal to cleaner biomass was not the only option to comply with the EPA rule. The utility explored burning lower-emissions coal, converting the unit to natural gas or installing pollution controls. "None of them proved to be viable options due to cost factors," Green said.

The cost of MATS has already driven Georgia Power to plan to retire more than 2,000 MW of generation. Last summer, the PSC approved the retirement of 16 coal- and oil-fired units. These generators will mostly be retired in 2015, with the exception of several units at the Kraft plant, where Georgia Power has sought a one-year extension to comply with MATS.

Many other plants have already been retired. Two years ago the utility received approval for retirements adding up to 500 MW, including one 33-MW oil-fired unit at Mitchell that was finally closed in March 2012. The plant has two other small oil units that will continue to operate, Green said.

Georgia Power owns 10,241.8 MW of coal-fired generation out of 19,605.7 MW total, according to SNL Energy data, making it the biggest coal plant operator of all the Southern subsidiary utilities. Southern itself is the second-largest coal plant owner in the country, after American Electric Power Co. Inc.

COMPANIES REFERENCED IN THIS ARTICLE:

American Electric Power Co. Inc.	**AEP**
Georgia Power Co.	
Southern Co.	**SO**

PR: Georgia Power to file decertification request for Plant Mitchell Unit 3

Read this article on SNL web.

Restrictions on Drummond's Colombian coal exports rippling through market

by Taylor Kuykendall

The effects of Colombia's suspension of Drummond Co. Inc.'s coal loading operations over environmental concerns are beginning to show up in world coal markets.

Bloomberg News reported Jan. 10 that the Baltic Dry Index, a measure of the cost to haul coal and other commodities, dropped 11.37% to 1,512 points, the biggest one-day drop on record, following export restrictions placed on Drummond. Bloomberg reported that rates for Capesize ships, which can carry up to 150,000 tonnes of coal, fell 27% to $17,452 a day, the largest daily drop since Oct. 2008.

Drummond also reported that its affiliate Interocean was forced to declare force majeure effective Jan. 13 as a result of the Colombian government's decision to halt coal shipments from its operations.

"We regret to inform you that Interocean must declare force majeure as a result of actions taken against Drummond in Colombia at our port in Cienaga," Interocean wrote in a notice to its customers. "Drummond experienced a long and protracted labor strike last year, of almost two months, during which time all of its operations in Colombia were under force majeure."

The company said that the Colombia government will close the port until a direct ship loading system is complete. Drummond currently loads ships at the port by crane.

"We shall continue our efforts and discussions with the Colombian government to explore alternatives for the port closure issue, but absent consideration of other possible alternatives by the government we anticipate loading will be suspended until March 2014," the notice states. "Should we have any updates to this time frame you will promptly be informed."

News of the stalled exports also reportedly drove European contract coal prices upward. The coal prices rose to $81/tonne for February contracts, while coal to be delivered in March settled at $80.40/tonne, the highest since Dec. 18, 2013, a Bloomberg report said.

Drummond spilled 2,000 tonnes of coal into the sea off the northern coast of Colombia in early 2013. In response, the Colombia government fined Drummond and introduced strict rules to regulate the loading of coal shipments.

A media representative for Drummond could not be reached for comment.

COMPANY REFERENCED IN THIS ARTICLE:

Drummond Co. Inc.

PR: Drummond Affiliate Notifies Customers of its Declaration of Force Majeure

Read this article on SNL web.

FBR Capital Markets upgrades Cloud Peak to 'outperform'

by Taylor Kuykendall

FBR Capital Markets upgraded Cloud Peak Energy Inc. from market perform to outperform, noting a boost in prices for Powder River Basin coal due to improving markets for thermal coal and the company's generation of free cash flow.

"Our investment thesis on Cloud Peak Energy Inc. is driven by its pure-play exposure to PRB prices," the report states. "PRB is our most preferred steam coal producing region, given its role in filling the void created by the declining Central Appalachian coal supply and low natural gas prices."

Analyst Mitesh Thakkar wrote in the Jan. 10 report that Cloud Peak has limited reinvestment capital expenditure requirements, which will allow the company to use surplus cash to buy outstanding debt or near-term accretive growth projects. He said a recent pullback in the company's stock, down 9% since a Dec. 10, 2013, high, has made the company's valuation more attractive.

Thakkar wrote that falling supply in Central Appalachia coal could provide upside to prices beyond FBR's current modeling of $12.50/ton for PRB coal. FBR's analysis suggests PRB prices are poised for a rebound, driven by shrinking coal stockpiles and competitiveness with natural gas.

"We believe PRB prices should recover to over $14+/ton eventually for the producers to earn decent return, given PRB is the lowest cost

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coal supply," the report states. "[Cloud Peak], being a pure play PRB producer, should be the prime beneficiary of this trend."

Thakkar also increased Cloud Peak's price target to $24 from $18. As of 10:04 a.m. Jan. 10, Cloud Peak was trading at $17.03/share.

COMPANY REFERENCED IN THIS ARTICLE:

Cloud Peak Energy Inc. **CLD**

Read this article on SNL web.

Stifel Nicolaus downgrades Natural Resource Partners on weak coal outlook

by Taylor Kuykendall

Stifel Nicolaus downgraded Natural Resource Partners LP from "buy" to "hold" on a weaker coal outlook for 2014.

In a Jan. 10 note, analyst Paul Forward said NRP's quarterly distribution of 35 cents per unit, announced Jan. 9, is "well short" of the 55 cents per unit the company has paid since the third quarter of 2011. He said the lower figure reflects ongoing poor U.S. coal markets and lower-than-expected guidance from the company for 2014.

"According to the firm, its coal lessees communicated an outlook for 2014 operating plans that was below its previous expectations, reflecting a weaker price and volume outlook in steam and metallurgical coal, which we attribute primarily to NRP's exposure to Appalachia," Forward wrote.

Stifel Nicolaus continues to view NRP as a lower-risk vehicle for investors to gain exposure to U.S. coal markets through royalty streams and infrastructure ownership.

COMPANY REFERENCED IN THIS ARTICLE:

Natural Resource Partners LP **NRP**

Read this article on SNL web.

Natural Resource Partners lowers 2014 guidance

by Rohan Somwanshi

Natural Resource Partners LP has lowered its 2014 guidance for coal royalty revenues by $28 million from the 2013 guidance range and pared its quarterly cash distribution by 36% in response to weak coal markets.

In a Form 8-K filed Jan. 9, the partnership said that while diversification into the soda ash and oil and gas businesses largely offset the decline in coal-related revenues in 2013, uncertain coal markets forced it to lower its guidance for 2014.

The partnership reduced its 2014 coal production guidance to a range from 43 million tons to 50 million tons, compared to the 2013 guidance of 50 million tons to 56 million tons.

Coal royalty revenues are expected to be in the range of $175 million to $195 million in 2014. Natural Resource Partners put 2014 guidance for distributable cash flow at $195 million to $230 million.

The partnership declared a fourth-quarter 2013 distribution of 35 cents per unit, down 20 cents per unit from the distribution paid in the third quarter of 2013. The distribution will be paid Jan. 31 to unit holders of record at the close of business Jan. 21.

The decrease announced in the distribution level will "enable the partnership to reduce its debt while preserving its liquidity to pursue accretive acquisitions," the partnership said. "NRP remains committed to its strategy to diversify its asset base and completed over $350 million of non-coal-related acquisitions in 2013."

"We did not see the recovery in the coal markets that we thought might occur over the course of 2013, but instead the markets weakened," Natural Resource Partners President and COO Nick Carter said.

COMPANY REFERENCED IN THIS ARTICLE:

Natural Resource Partners LP **NRP**

8-K: Natural Resource Partners LP (NRP)

Read this article on SNL web.

World Coal CEO: Industry must be 'part of the solution to climate change'

by Taylor Kuykendall

The latest issue of *Cornerstone*, "the official journal of the world coal industry," stressed the urgency of developing carbon capture and storage technology if coal is to meet world energy needs under increasing pressure to reduce greenhouse gas emissions.

Executive Editor Holly Krutka wrote in the winter issue of the World Coal Association's trade magazine that fossil fuel growth shows no signs of slowing. Based on the risks associated with "unchecked climate change," financing coal projects without innovation that balances growth and environmental protection is becoming increasingly rare.

Krutka wrote that leaders should insist that all new coal-fired power plants meet the highest possible efficiency standards in order to seize the opportunity for emissions improvements. In addition, however, carbon capture technologies will be necessary to meet global carbon dioxide reduction goals.

"Although the hurdles are high, the critical nature of the end goal cannot be denied: a low-carbon, low-emission coal-conversion energy system," Krutka said.

The magazine features an interview with Brad Page, head of the Global Carbon Capture and Storage Institute. He said fossil fuels will continue to be the world's primary source of energy, and more carbon-reducing projects are needed to face "the greatest challenges the world faces today."

"Currently, CCS technology to mitigate emissions is expensive and energy intensive, especially for power plants, whether coal- or natural gas-based," Page said. "The Institute's broad membership includes representatives from the coal industry, whom we consult to set priorities, gain insight into challenges and issues, and inform our strategy to move CCS forward."

The WCA recently hosted the International Coal & Climate Summit, or ICCS, an event reviewed in the magazine by Milton Catelin, CEO of the WCA. The event stirred controversy for being scheduled at the same time and in the same city — Warsaw — as the United Nation's climate talks. "As an industry that provides over 40% of global electricity and 30% of primary energy — forecast to overtake oil over coming years — it's clear that we have to be part of the solution to climate change," Catelin said.

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Catelin said the world coal industry is committed to practical solutions for climate change and is open to dialogue. He said leaving the industry out of climate change negotiations would represent a missed opportunity to reduce emissions from a major source of greenhouse gases.

"It's all too easy to talk of leaving coal in the ground and closing power stations," Catelin said. "Our hope in holding ICCS was to encourage constructive dialogue on practical solutions — to start a conversation that can lead to a better balance between climate protection and economic development/poverty alleviation."

One report from the Clean Air Task Force included in the industry's magazine concludes that U.S. EPA regulation to limit carbon dioxide emissions "doesn't end U.S. coal," but instead marks a beginning for carbon capture technology. The task force concludes that the rule will actually help the industry.

"We think the rule provides the certainty that is needed with respect to future carbon liability," the article states. "Most proposed coal-fired power plants in the U.S. in the last five years already included CCS in order to limit this uncertainty facing investors."

In the U.S., support of carbon capture has weakened in favor of slowing or stopping carbon dioxide regulations, as proposed by a bill just introduced in the U.S. Congress and endorsed by the National Mining Association. "This bill sensibly requires that EPA base greenhouse gas emission standards for power plants on technology that is proven and commercially available," NMA President and CEO Hal Quinn said in a Jan. 9 statement. "The agency's current proposal fails this obvious test for reasonable standard setting, gambling on unproven technology and risking far higher electricity costs."

The magazine, available at no cost on the WCA website, also highlighted the progress and challenges of specific carbon capture projects around the world.

Read this article on SNL web.

China Coal to invest 17B Chinese yuan in Shaanxi-based project

by Sheharyar Khan

China Coal Energy Co. Ltd. on Jan. 10 received board approvals to invest approximately 17.03 billion Chinese yuan on a new coal project in China's Shaanxi province.

The company said it will develop the Dahaize coal project via its wholly owned subsidiary, China Coal Shaanxi Yulin Energy and Chemical Co. Ltd., in addition to a coal preparation plant in the Yuheng mineral area; the project is in line with company strategy to increase production capacity and create a large coal manufacture and transformation base in the region of Inner Mongolia and Shaanxi.

Dahaize will take approximately 65 months to complete and will have an annual production capacity of 15 million tonnes of coal with a post-tax, 19.55% internal rate of return.

The company will inject 5.18 billion yuan, or 30.40% of the total investment, in China Coal Shaanxi to begin development while the remaining 11.8 billion yuan, or 69.60% of the total investment, will be settled via external financing such as bank loans.

Dahaize hosts recoverable coal reserves of 3.28 billion tonnes classified as non-caking with ultra-low ash, good for civil, gasification and power use.

As of Jan. 9, US$1 was equivalent to 6.05 Chinese yuan.

COMPANY REFERENCED IN THIS ARTICLE:

China Coal Energy Co. Ltd. **1898**

PR: China Coal Energy Co. Ltd.: ANNOUNCEMENT INSIDE INFORMATION

Read this article on SNL web.

Report: Germany's 2013 coal use the highest since 1990 as nuclear phased out

by Kalayaan Teodoro

Electricity generated from lignite coal in Germany in 2013 increased to its highest level since 1990 despite a push for clean energy, the *Financial Times* reported Jan. 7.

In 2013, Germany generated 162 billion kWh from lignite, up from 161 billion kWh in 2012 and the highest since 171 billion kWh in 1990, according to EnergieBilanz data obtained by the *Times*.

The report pointed to German Chancellor Angela Merkel's move to phase out nuclear power as a factor in the rise in use of fossil fuels, despite a steady increase in renewable power in the past decade.

Meanwhile, the country's lignite industry association Debriv said that investments in new generators have resulted in more efficient coal usage and reduced actual mining of the resource by 2% in 2013, according to the report.

In October 2013, the head of an energy lobby group said coal will remain essential in Germany's energy mix for the foreseeable future.

Read this article on SNL web.

North Asia Resources warns of wider loss for 2013, ordered to rectify coal mines

by Sheharyar Khan

North Asia Resources Holdings Ltd. said Jan. 10 that it expects a "significant increase" in its loss for the full year 2013 compared to HK$114.4 million loss booked in 2012, mainly due to a noncash impairment and an increase in finance costs.

The company based its assessment on a preliminary review of results for the 11 months to Nov. 30, 2013. North Asia Resources said it will release its annual results before the end of March.

Separately, the company said that following its decision to suspend development across various coal projects in China's Shanxi province in October 2013, it received notices from relevant authorities to implement a rectification scheme.

The company submitted its rectification plan and will have 15 to 45 working days after receiving approvals to carry out measures on the hydrological and geological conditions, ventilation and gas

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management, site conditions and sequence of construction. Subject to a successful outcome, the company will then apply to resume construction and development work across various operations in Shanxi.

Commercial production from North Asia's operations in the Shanxi is expected to start by Jan. 1, 2015.

COMPANY REFERENCED IN THIS ARTICLE:

North Asia Resources Holdings Ltd.	**61**

Fin Supp: North Asia Resources (61)

Read this article on SNL web.

Report: India's Lanco eyeing sale of Australian coal unit

by Kalayaan Teodoro

In a possible debt reduction move, India's Lanco Infratech Ltd. is exploring the sale of its Australian unit, Griffin Coal, Bloomberg News reported Jan. 9, citing three unnamed sources with knowledge of the matter.

Lanco is considering selling unprofitable Griffin Coal after reaching an agreement with banks to restructure its debt, which reached 339 billion Indian rupees in September 2013, Bloomberg reported.

Lanco acquired Griffin Coal in Western Australia's Collie Basin in March 2011. Griffin Coal's mines have a production capacity of 4 million tonnes per year, which Lanco aims to increase to 18 million tonnes per year by fiscal 2018.

The weak global market for coal and restrictive government policies have hit Australia's coal industry hard in the past years.

COMPANIES REFERENCED IN THIS ARTICLE:

Griffin Coal
Lanco Infratech Ltd.

Read this article on SNL web.

Coal India files appeal over fine for alleged unfair trade practices

by Kalayaan Teodoro

Coal India Ltd. has filed an appeal of the fine of 17.73 billion Indian rupees imposed on it by the Competition Commission of India for alleged unfair trade practices, Press Trust of India reported Jan. 9.

The state-owned miner filed the appeal with the Competition Appellate Tribunal of India, which is expected to hold a hearing on the matter in the week of Jan. 13.

A regulatory order issued Dec. 9, 2013, said Coal India abused its dominant position in the production and supply of noncoking coal in the country. Coal India said a few days later that it would appeal the penalty.

As of Jan. 9, US$1 was equivalent to 62.05 Indian rupees.

COMPANY REFERENCED IN THIS ARTICLE:

Coal India Ltd.	**533278**

Read this article on SNL web.

Report: India's coal, coke imports total 141.5 million tonnes in 2013

by Rohan Somwanshi

India's coal and coke imports in 2013 are estimated at 141.5 million tonnes, SteelGuru.com reported Jan. 9, citing preliminary data from major ports.

India imported 107.8 million tonnes of thermal coal and 30.7 million tonnes of coking coal in 2013, according to the report.

Indonesia was the major supplier of thermal coal to India with about a 75% share of the imports, while Australia remained the top coking coal supplier, accounting for 84% of total imports. The largest amount of imports were made in July 2013, at 13.4 million tonnes, with average monthly coal imports totaling 11.8 million tonnes.

The Mundra port imported the highest coal volumes in 2013, at 33.1 million tonnes, followed by Krishnapatnam, at about 18.6 million tonnes. About 2,300 coal vessels were unloaded at Indian ports during 2013, the report said.

Read this article on SNL web.

Coal India will miss fiscal 2014 output target, chairman says

by Rohan Somwanshi

Coal India Ltd. is again set to miss its annual coal production target, the Press Trust of India reported Jan. 9, citing the company's chairman and managing director.

The company could fall 5 million tonnes short of the 482 million tonne target for the fiscal year ending in March, according to the report.

A cyclone in October 2013 and a production disruption in November 2013 due to law-and-order issues are among the reasons for the expected shortfall, according to Chairman and Managing Director S. Narsing Rao.

Coal India has missed its annual production targets for the past four fiscal years. The company produced 452.2 million tonnes of coal

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in the fiscal year ended March 2013, compared to the target of 464.1 million tonnes.

Coal India accounts for more than 80% of domestic coal production.

COMPANY REFERENCED IN THIS ARTICLE:

Coal India Ltd.	**533278**

Read this article on SNL web.

Coalspur Mines clears remaining First Nation intervenor for Vista coal project

by Fawad Mir

Coalspur Mines Ltd. said Jan. 9 that the Alexis Nakota Sioux Nation agreed to withdraw as an intervenor to the company's Vista thermal coal project in Alberta.

Alexis Nakota was the last remaining First Nation group granted intervenor status by the Alberta Energy Regulator, Coalspur said.

The agreement provides community infrastructure and programs for Alexis, and ensures the aboriginal group's participation in the reclamation and ongoing environmental monitoring of the Vista operation.

Following the withdrawal of Alexis, there are no intervenors for the Vista project other than an individual who has been granted a conditional opportunity to make a 30-minute presentation to the regulator.

The exit of Alexis followed the withdrawal of Tourmaline Oil Corp. and two aboriginal communities — Ermineskin Cree Nation and Whitefish Lake First Nation, in December 2013 as intervenors to the project.

The company has asked the Alberta Energy Regulator to cancel the Jan. 13 hearing since agreements with all relevant parties are now finalized. The regulator is expected to give a decision on the project within the next 90 days.

Meanwhile, Coalspur is working with various regulatory agencies to secure final approvals and permits for the Vista project.

The company is looking forward "to securing regulatory approval and being in a position to finalize our funding arrangements for the construction of Vista," Coalspur President and CEO Gill Winckler said.

COMPANY REFERENCED IN THIS ARTICLE:

Coalspur Mines Ltd.	**CPL**

Read this article on SNL web.

Guildford Coal receives US$65M financing from OCP Asia

by Fawad Mir

Guildford Coal Ltd. said Jan. 10 that it completed the financing facility with OCP Asia and received US$65 million.

The company received US$10 million in exchange for its convertible notes and US$55 million for amortizing notes. It also issued detachable warrants for an amount equal to 18.5% of the amortizing notes.

Guildford Coal announced the completion of negotiations and inking of long-form documents for new financing arrangements with OCP Asia in late December 2013.

Proceeds will be used to repay its existing debt owed to OCP Asia and for working capital purposes related to its Mongolian assets, the statement said.

COMPANY REFERENCED IN THIS ARTICLE:

Guildford Coal Ltd.	**GUF**

PR: Guildford Coal Ltd.: OCP Asia Financing Facility Completion

Read this article on SNL web.

White House *continued*

amend language in the draft rule that suggests the technology is "well-established and already in widespread commercial practice."

The OMB also said the EPA's cost analysis of CCS technology suffers a "significant selection bias," given that it factors in projects that have benefited from significant government funding and other subsidies. By basing its analysis on such projects, the EPA has understated the costs and risks of CCS technology, the OMB said.

The EPA's greenhouse gas rule for new power plants has been no stranger to controversy. Coal industry advocates contend that the technology is prohibitively expensive and not sufficiently demonstrated to be mandated and, as such, will represent a de facto ban on new coal plants. But in a twist, the criticism leveled at the EPA this time has originated from within the Obama administration.

The OMB's questions, and the EPA's responses, were made available in coordination with the EPA's publication of the carbon standard for new power plants in the Federal Register on Jan. 8. The email from Robert Wayland, leader of the energy strategies group of the EPA's Office of Air Quality Planning and Standards, was sent Aug. 19, 2013, to Nathan Frey, of the OMB's Office of Information and Regulatory Affairs. At this time, it remains unclear to what extent the OMB's recommendations were incorporated into the latest draft rule.

To reflect the fact that CCS has not been deployed at scale in commercial power plants, the OMB had recommended that the EPA build in flexibilities in the rule. The OMB said such flexibilities are needed to expand deployment of CCS and, in turn, attain the technical potential and cost goals of the CCS technology envisioned in the rule.

The EPA, however, suggested that such flexibilities are already found in the proposed rule, noting that only partial, not full, CO2 capture is required and that the emissions can be averaged over several years. The EPA also steadfastly defended its basis for finding that CCS can be mandated, saying "the evidence supports the finding that implementation of CCS technology to meet the proposed standard is technically feasible."

Still other questions from the OMB concerned CCS cost estimates. The OMB asked how it was that the EPA found that partial capture of CO2, at 65%, costs so much less than 90% capture, which is estimated by the agency to cost a further $812/kW in capital expenditures.

The OMB asserted that the EPA failed to properly address the fact that its rule will have disparate regional impacts, given that the geologic formations needed for sequestering CO2 are not uniformly available across the nation. For its part, the EPA maintained that the rule adequately explains why CCS with partial capture is attainable throughout the entire country.

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Other noteworthy exchanges

The OMB questioned whether in complying with the EPA's proposed standard coal-fired facilities can employ technologies other than CCS, such as chemical looping and oxy-combustion. The EPA responded that sources "are free to utilize other advanced technologies" to meet the standard of performance.

The OMB asked whether the EPA should have considered the environmental impact of the greenhouse gas emissions from the oil obtained using power plant CO2. The EPA, however, said it had declined to do so, asserting that the amount of oil recovered using captured power plant CO2 is not likely to impact total CO2 emissions from oil production and consumption.

The OMB recommended and the EPA consented to considering changing the emissions limits in the proposed rule on which it will take comment to a range of 900 pounds of CO2 per MWh to 1,200 lbs/MWh. That compares to the original range of emissions limits on which it is soliciting comment of 1,000 lbs/MWh to 1,200 lbs/MWh. The OMB said solicitation of comments on an emissions limit of 900 lbs/MWh is warranted given that such a level is about equal to what is, or will be, achieved at Basin Electric Power Cooperative's Great Plains Synfuels Plant, a commercial-scale coal gasification plant near Beulah, N.D., and Mississippi Power Co.'s Plant Ratcliffe in Kemper County, Miss.

The EPA also confronted questions from the OMB about the rationale of the rule. The OMB asked what the basis for issuing the rule was if, as EPA found, "no reasonable forecast predicts a cost advantage to building an electric generating unit (EGU) that would not be compliant with the proposed standard."

The EPA recalled that it was under marching orders by President Barack Obama to issue a rule for new power plants by Sept. 20, 2013, and to roll out the regulations as a precursor to issuing rules for existing power plants. Moreover, the regulation of new power plants, the EPA said, is consistent with the administration's policy objectives and follows the agency's endangerment finding that greenhouse gases, as contributors to climate change, threaten to harm public health and welfare.

The OMB also expressed concern with the fact that natural gas peaking plants were exempted in the rule and not subject to a less stringent emissions limit. The OMB said that given its role in supporting intermittent renewable energy, the expanded deployment of uncontrolled simple-cycle plants could "lead to higher overall power sector carbon emissions." The EPA responded that it is still considering this issue.

The OMB questioned whether the greenhouse gas rules alone, absent external market forces, could in fact catalyze the private sector to invest in greenhouse gas emissions reduction technology, as anticipated by the EPA.

The EPA responded, "We believe that the regulatory certainty offered by this rule — which will require new fossil fuel-fired boilers and IGCC units to capture a fraction of the produced CO2 — can incentivize further development of carbon capture technologies."

The EPA added that an emissions limit based on "best generating technology" by contrast would not provide a clear incentive for additional research, development and demonstration of CCS given that complying with such a standard would not require deployment of that technology. The EPA also highlighted the fact that it is not requiring full CO2 capture, as such a mandate could impose "excessive costs" that could stifle CCS research and development. The EPA's proposed rule requires a portion of the gas to be captured, estimated to be in a range of 30% to 50% of a plant's carbon pollution, depending on the unit.

The EPA said it anticipates that some companies may make "non-purely-market-driven investment decisions."

The EPA also said it has considered identifying natural gas, combined-cycle units as an alternative to CCS for determining the "best system of emission reduction," or BSER, for coal-fired power plants. That presents a difference from the newly released draft rule in which the agency proposed to find that CCS alone is BSER for coal-fired power plants.

Mississippi Power is a Southern Co. subsidiary.

COMPANIES REFERENCED IN THIS ARTICLE:

Basin Electric Power Cooperative

Mississippi Power Co.

Southern Co. **SO**

Industry Document: Summary of Interagency Working Comments on Draft Language under EO12866 Interagency Review

Industry Document: Summary of Interagency Comments Under EO 12866/13564 EGU GHG NSPS

Industry Document: GOP Says Utility NSPS Runs Afoul of Energy Law

Read this article on SNL web.

Coal equities *continued*

The firm's 2014 supply and demand expectations remain largely unchanged from October 2013. "We expect a 50 million ton (MT) or 5-6% increase in final 2013 US thermal coal demand, with further gains (2%) during 2014," Dudas wrote. On the supply side, the report said producers cut supply by almost 80 million tons in 2012. Sterne Agee expects a decline of 15 million tons of production in 2013, before a rebound of 15 million to 20 million tons in 2014.

But the supply growth would shake out differently among supply basins. "We suggest that displacement and coal pricing economics would continue to drive Central Appalachia production lower in 2014E," the report said. "Although we expect some incremental pick-up in [Powder River Basin] demand in 2014E as $4.00 gas prices make PRB coals more economic for almost all plants, we forecast [a] PRB production increase of less than 2% in 2014E as utilities work down their inventories."

"Northern [Appalachia] should witness some uptick in production when CONSOL's BMX mine comes online in 2014E. Investment

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in newer, better capitalized and lower operating cost underground deposits and utility-dedicated output throughout the Illinois Basin should generate positive volume growth in 2014," the report continued.

Sterne Agee continues to expect utilities to work down their inventories through 2014 as weather normalizes, natural gas prices remain elevated and supply lags.

"We believe utilities, especially merchant generators, would continue to face scrutiny on stockpiles," the report said. "Plant managers would strive for lower than current stockpile levels on a days of coal burn basis. Our 125 [million ton] coal stockpile target for 2014E end would equate to 50 days of coal burn."

"As utilities start working down inventories in 2013-14E, we expect pricing to [pick up] on expectations of increased contracting in 2014 and beyond," the report said.

Sterne Agee's inventory expectations are more bullish than those of the U.S. Energy Information Administration, which projected 2014 year-end secondary stockpiles of 152.5 million tons in its Jan. 7 "Short-Term Energy Outlook."

"Higher natural gas prices (>$4.00) and lower coal stockpiles should bode well for 2015 CAPP and PRB prices. We do not expect PRB producers with spare capacity to bring this latent production online in 2015; we expect producers to continue to show restraint [until] they see sustained improvement in pricing," Dudas wrote.

Regarding the seaborne market, Sterne Agee said current API2 prices of roughly $80/tonne are at trough levels. The firm expects global seaborne supply growth to drop amid legacy contract expiration and marginal production rationalization.

Outlook for metallurgical coal market not as bullish

Sterne Agee lowered its expectations for met coal due to the current market surplus "that would likely take some time to get worked down." The firm hacked its 2014 met coal outlook by 20.5% to $155/tonne and has initiated its 2015 outlook at $180/tonne.

"[Increased demand] and supply rationalization should bring met markets closer to balance, in our view, leading to higher prices from 2H14 onwards," the report said. "We believe the disconnect between iron ore and coking coal prices provides room for coking coal prices to rise from these levels. Increased supply coming into [the] market should pressure iron ore prices in 2014. Even if steel prices remain stagnant, and if iron ore prices decline to $100/[tonne], coking coal prices could go up to almost $210/[tonne] before steel mill margins drop below the previous four-year average, or $235/[tonne] before steel margins fall below current levels."

The report also said that continued weakness in the Australian dollar could pose a risk to both its seaborne and met coal price outlook.

COMPANIES REFERENCED IN THIS ARTICLE:

Alpha Natural Resources Inc.	**ANR**
Arch Coal Inc.	**ACI**
CONSOL Energy Inc.	**CNX**
Peabody Energy Corp.	**BTU**

Sterne Agee & Leach Inc. Industry Report: 2014 Outlook - Clearing Supply, Less Turbulence, Lower Stockpiles, Reducing 2014-15 Est - ACI, ANR, BTU, CNX, JRCC & WLT

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THE UNIVERSITY OF TEXAS AT AUSTIN

Climate Systems Science

Reality of Human Influence on Global Climate

We, the members and colleagues of the Jackson School of Geosciences program in Climate Systems Science, agree with the scientific assessment presented in reports by the Intergovernmental Panel on Climate Change that

1. Warming of the climate system is unequivocal, as is now evident from observations of increases in global averaged air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.

2. Most of the observed increase in global averaged temperatures since 1950 is very likely due to the observed increase in greenhouse gas concentrations from human activity.

3. Global warming and sea level rise will continue for centuries due to the time scales associated with the climate system, even if greenhouse gas concentrations were to be stabilized.

4. These anticipated changes in regional and global climate could have severe adverse impacts on the environment and society.

For more information about the JSG program in Climate Systems Science click here.
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Census.gov › People and Households › Poverty Main › About Poverty › Highlights

Highlights

The data presented here are from the Current Population Survey (CPS), 2013 Annual Social and Economic Supplement (ASEC), the source of official poverty estimates. The CPS ASEC is a sample survey of approximately 100,000 household nationwide. These data reflect conditions in calendar year 2012.

- In 2012, the official poverty rate was 15.0 percent. There were 46.5 million people in poverty.
- For the second consecutive year, neither the official poverty rate nor the number of people in poverty at the national level were statistically different from the previous year's estimates.
- The 2012 poverty rate was 2.5 percentage points higher than in 2007, the year before the most recent recession.
- In 2012, the poverty rate for people living in the West was statistically lower than the 2011 estimate.
- For most groups, the number of people in poverty did not show a statistically significant change. However, between 2011 and 2012, the number of people in poverty did increase for people aged 65 and older, people living in the South, and people living outside metropolitan statistical areas.
- The poverty rate in 2012 for children under age 18 was 21.8 percent. The poverty rate for people aged 18 to 64 was 13.7 percent, while the rate for people aged 65 and older was 9.1 percent. None of these poverty rates were statistically different from their 2011 estimates.[1]

Footnotes:

1 Since unrelated individuals under 15 are excluded from the poverty universe, there are 468,000 fewer children in the poverty universe than in the total civilian noninstitutionalized population.

Source: U.S. Census Bureau | Social, Economic, and Housing Statistics Division: Poverty | Last Revised: September 17, 2013

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EMBARGOED UNTIL RELEASE AT 8:30 A.M. EST, FRIDAY, FEBRUARY 27, 2009 BEA 09-05

* See the navigation bar at the right side of the news release text for links to data tables, contact personnel and their telephone numbers, and supplementary materials.

Lisa Mataloni :	(202) 606-5304 (GDP)
Recorded message:	(202) 606-5306

GROSS DOMESTIC PRODUCT: FOURTH QUARTER 2008 (PRELIMINARY)

Real gross domestic product -- the output of goods and services produced by labor and property located in the United States -- decreased at an annual rate of 6.2 percent in the fourth quarter of 2008, (that is, from the third quarter to the fourth quarter), according to preliminary estimates released by the Bureau of Economic Analysis. In the third quarter, real GDP decreased 0.5 percent.

The GDP estimates released today are based on more complete source data than were available for the advance estimates issued last month. In the advance estimates, the decrease in real GDP was 3.8 percent (see "Revisions" on page 3).

The decrease in real GDP in the fourth quarter primarily reflected negative contributions from exports, personal consumption expenditures, equipment and software, and residential fixed investment that were partly offset by a positive contribution from federal government spending. Imports, which are a subtraction in the calculation of GDP, decreased.

Most of the major components contributed to the much larger decrease in real GDP in the fourth quarter than in the third. The largest contributors were a downturn in exports and a much larger decrease in equipment and software. The most notable offset was a much larger decrease in imports.

Final sales of computers subtracted 0.01 percentage point from the fourth-quarter change in real GDP, the same contribution as in the third quarter. Motor vehicle output subtracted 2.04 percentage points from the fourth-quarter change in real GDP after adding 0.16 percentage point to the third-quarter change.

FOOTNOTE.--Quarterly estimates are expressed at seasonally adjusted annual rates, unless otherwise specified. Quarter-to-quarter dollar changes are differences between these published estimates. Percent changes are calculated from unrounded data and are annualized. "Real" estimates are in chained (2000) dollars. Price indexes are chain-type measures.

This news release is available on BEA's Web site along with the Technical Note and Highlights related to this release.

The price index for gross domestic purchases, which measures prices paid by U.S. residents, decreased 4.1 percent in the fourth quarter, 0.5 percentage point less of a decrease than in the advance estimate; this index increased 4.5 percent in the third quarter. Excluding food and energy prices, the price index for gross domestic purchases increased 1.1 percent in the fourth quarter, compared with an increase of 2.8 percent in the third.

Real personal consumption expenditures decreased 4.3 percent in the fourth quarter, compared with a decrease of 3.8 percent in the third. Real nonresidential fixed investment decreased 21.1 percent, compared with a decrease of 1.7 percent. Nonresidential structures decreased 5.9 percent, in contrast to an increase of 9.7 percent. Equipment and software decreased 28.8 percent, compared with a decrease of 7.5 percent. Real residential fixed investment decreased 22.2 percent, compared with a decrease of 16.0 percent.

Real exports of goods and services decreased 23.6 percent in the fourth quarter, in contrast to an increase of 3.0 percent in the third. Real imports of goods and services decreased 16.0 percent, compared with a decrease of 3.5 percent.

Real federal government consumption expenditures and gross investment increased 6.7 percent in the fourth quarter, compared with an increase of 13.8 percent in the third. National defense increased 3.1 percent, compared with an increase of 18.0 percent. Nondefense increased 15.1 percent, compared with an increase of 5.1 percent. Real state and local government consumption expenditures and gross investment decreased 1.4 percent, in contrast to an increase of 1.3 percent.

The real change in private inventories added 0.16 percentage point to the fourth-quarter change in real GDP, after adding 0.84 percentage point to the third-quarter change. Private businesses decreased inventories $19.9 billion in the fourth quarter, following a decrease of $29.6 billion in the third quarter and a decrease of $50.6 billion in the second.

Real final sales of domestic product -- GDP less change in private inventories -- decreased 6.4 percent in the fourth quarter, compared with a decrease of 1.3 percent in the third.

Gross domestic purchases

Real gross domestic purchases -- purchases by U.S. residents of goods and services wherever produced -- decreased 5.6 percent in the fourth quarter, compared with a decrease of 1.5 percent in the

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third.

Current-dollar GDP

Current-dollar GDP -- the market value of the nation's output of goods and services -- decreased 5.8 percent, or $212.5 billion, in the fourth quarter to a level of $14,200.3 billion. In the third quarter, current-dollar GDP increased 3.4 percent, or $118.3 billion.

Revisions

The preliminary estimate of the fourth-quarter change in real GDP is 2.4 percentage points, or $74.4 billion, lower than the advance estimate issued last month. The downward revision to the percent change in real GDP was widespread; the largest contributors were downward revisions to private inventory investment, to exports, and to personal consumption expenditures for nondurable goods.

	Advance	Preliminary
	(Percent change from preceding quarter)	
Real GDP......................................	-3.8	-6.2
Current-dollar GDP............................	-4.1	-5.8
Gross domestic purchases price index...........	-4.6	-4.1

2008 GDP

Real GDP increased 1.1 percent in 2008 (that is, from the 2007 annual level to the 2008 annual level), compared with an increase of 2.0 percent in 2007.

The major contributors to the increase in real GDP in 2008 were exports, personal consumption expenditures (PCE) for services, federal government spending, nonresidential structures, and state and local government spending. These were partly offset by negative contributions from residential fixed investment, PCE for goods, private inventory investment, and equipment and software. Imports, which are a subtraction in the calculation of GDP, decreased.

The slowdown in real GDP in 2008 primarily reflected a sharp deceleration in PCE, a downturn in equipment and software, and decelerations in exports and in state and local government spending that were partly offset by a sharp downturn in imports, an acceleration in federal government spending, and a smaller decrease in private inventory investment.

The price index for gross domestic purchases increased 3.2 percent in 2008, compared with an increase of 2.8 percent in 2007.

Current-dollar GDP increased 3.3 percent, or $457.0 billion, in 2008. Current-dollar GDP increased 4.8 percent, or $629.2 billion, in 2007.

During 2008 (that is, measured from the fourth quarter of 2007 to the fourth quarter 2008), real GDP decreased 0.8 percent. Real GDP increased 2.3 percent during 2007. The price index for gross domestic purchases increased 2.0 percent during 2008, compared with an increase of 3.3 percent during 2007.

* * *

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* * *

Next release -- March 26, 2009, at 8:30 A.M. EDT for:
Gross Domestic Product: Fourth Quarter 2008 (Final)
Corporate Profits: Fourth Quarter 2008

Last Modified: Thursday, June 02, 2011

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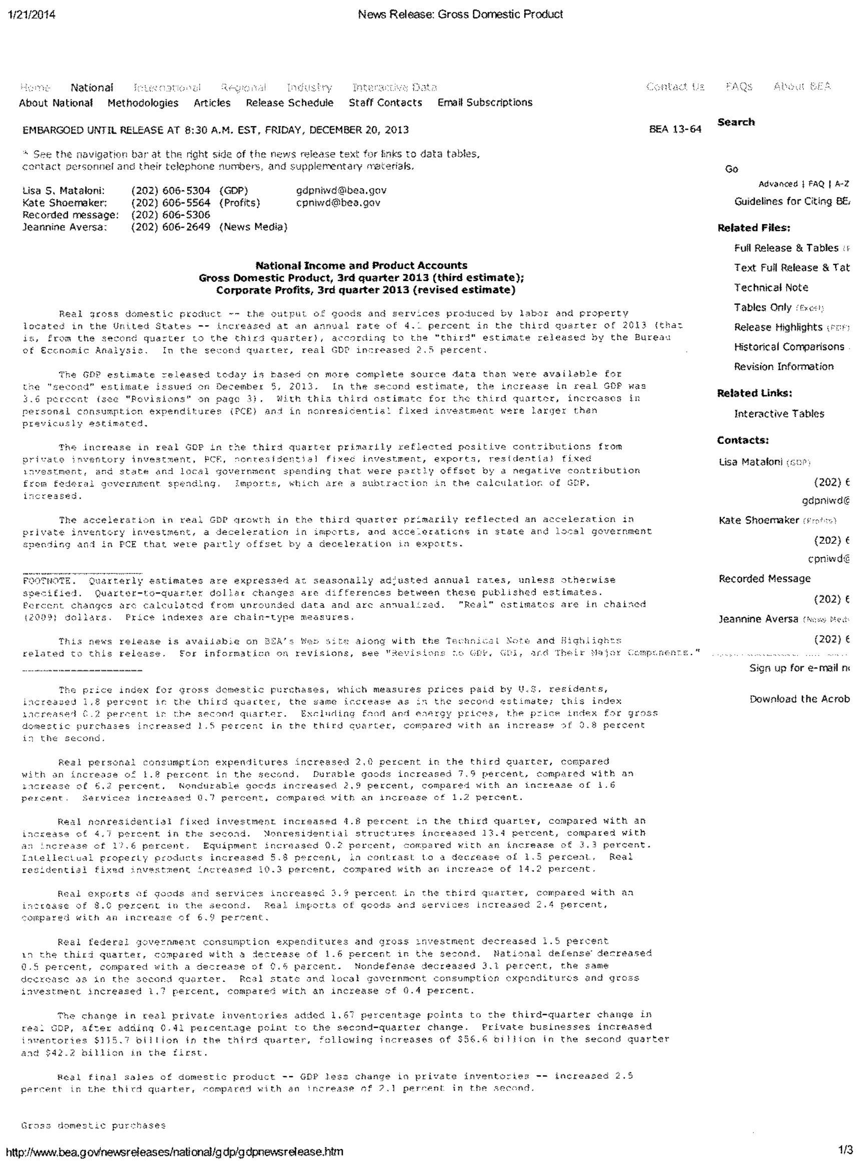

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EMBARGOED UNTIL RELEASE AT 8:30 A.M. EST, FRIDAY, DECEMBER 20, 2013 BEA 13-64

* See the navigation bar at the right side of the news release text for links to data tables, contact personnel and their telephone numbers, and supplementary materials.

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National Income and Product Accounts
Gross Domestic Product, 3rd quarter 2013 (third estimate);
Corporate Profits, 3rd quarter 2013 (revised estimate)

Real gross domestic product -- the output of goods and services produced by labor and property located in the United States -- increased at an annual rate of 4.1 percent in the third quarter of 2013 (that is, from the second quarter to the third quarter), according to the "third" estimate released by the Bureau of Economic Analysis. In the second quarter, real GDP increased 2.5 percent.

The GDP estimate released today is based on more complete source data than were available for the "second" estimate issued on December 5, 2013. In the second estimate, the increase in real GDP was 3.6 percent (see "Revisions" on page 3). With this third estimate for the third quarter, increases in personal consumption expenditures (PCE) and in nonresidential fixed investment were larger than previously estimated.

The increase in real GDP in the third quarter primarily reflected positive contributions from private inventory investment, PCE, nonresidential fixed investment, exports, residential fixed investment, and state and local government spending that were partly offset by a negative contribution from federal government spending. Imports, which are a subtraction in the calculation of GDP, increased.

The acceleration in real GDP growth in the third quarter primarily reflected an acceleration in private inventory investment, a deceleration in imports, and accelerations in state and local government spending and in PCE that were partly offset by a deceleration in exports.

FOOTNOTE. Quarterly estimates are expressed at seasonally adjusted annual rates, unless otherwise specified. Quarter-to-quarter dollar changes are differences between these published estimates. Percent changes are calculated from unrounded data and are annualized. "Real" estimates are in chained (2009) dollars. Price indexes are chain-type measures.

This news release is available on BEA's Web site along with the Technical Note and Highlights related to this release. For information on revisions, see "Revisions to GDP, GDI, and Their Major Components."

The price index for gross domestic purchases, which measures prices paid by U.S. residents, increased 1.8 percent in the third quarter, the same increase as in the second estimate; this index increased 0.2 percent in the second quarter. Excluding food and energy prices, the price index for gross domestic purchases increased 1.5 percent in the third quarter, compared with an increase of 0.8 percent in the second.

Real personal consumption expenditures increased 2.0 percent in the third quarter, compared with an increase of 1.8 percent in the second. Durable goods increased 7.9 percent, compared with an increase of 6.2 percent. Nondurable goods increased 2.9 percent, compared with an increase of 1.6 percent. Services increased 0.7 percent, compared with an increase of 1.2 percent.

Real nonresidential fixed investment increased 4.8 percent in the third quarter, compared with an increase of 4.7 percent in the second. Nonresidential structures increased 13.4 percent, compared with an increase of 17.6 percent. Equipment increased 0.2 percent, compared with an increase of 3.3 percent. Intellectual property products increased 5.8 percent, in contrast to a decrease of 1.5 percent. Real residential fixed investment increased 10.3 percent, compared with an increase of 14.2 percent.

Real exports of goods and services increased 3.9 percent in the third quarter, compared with an increase of 8.0 percent in the second. Real imports of goods and services increased 2.4 percent, compared with an increase of 6.9 percent.

Real federal government consumption expenditures and gross investment decreased 1.5 percent in the third quarter, compared with a decrease of 1.6 percent in the second. National defense decreased 0.5 percent, compared with a decrease of 0.6 percent. Nondefense decreased 3.1 percent, the same decrease as in the second quarter. Real state and local government consumption expenditures and gross investment increased 1.7 percent, compared with an increase of 0.4 percent.

The change in real private inventories added 1.67 percentage points to the third-quarter change in real GDP, after adding 0.41 percentage point to the second-quarter change. Private businesses increased inventories $115.7 billion in the third quarter, following increases of $56.6 billion in the second quarter and $42.2 billion in the first.

Real final sales of domestic product -- GDP less change in private inventories -- increased 2.5 percent in the third quarter, compared with an increase of 2.1 percent in the second.

Gross domestic purchases

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Real gross domestic purchases -- purchases by U.S. residents of goods and services wherever produced -- increased 3.9 percent in the third quarter, compared with an increase of 2.5 percent in the second.

Gross national product

Real gross national product -- the goods and services produced by the labor and property supplied by U.S. residents -- increased 4.4 percent in the third quarter, compared with an increase of 2.7 percent in the second. GNP includes, and GDP excludes, net receipts of income from the rest of the world, which increased $12.7 billion in the third quarter after increasing $7.7 billion in the second; in the third quarter, receipts increased $1.0 billion, and payments decreased $11.7 billion.

Current-dollar GDP

Current-dollar GDP -- the market value of the nation's output of goods and services -- increased 6.2 percent, or $251.9 billion, in the third quarter to a level of $16,912.9 billion. In the second quarter, current-dollar GDP increased 3.1 percent, or $125.7 billion.

Gross domestic income

Real gross domestic income (GDI), which measures the output of the economy as the costs incurred and the incomes earned in the production of GDP, increased 1.8 percent in the third quarter, compared with an increase of 3.2 percent in the second. In the second estimate, the increase in real GDI was 1.4 percent. For a given quarter, the estimates of GDP and GDI may differ for a variety of reasons, including the incorporation of largely independent source data. However, over longer time spans, the estimates of GDP and GDI tend to follow similar patterns of change.

Revisions

The upward revision to the percent change in real GDP primarily reflected upward revisions to personal consumption expenditures and to nonresidential fixed investment that were partly offset by a downward revision to residential fixed investment.

	Advance Estimate	Second Estimate	Third Estimate
	(Percent change from preceding quarter)		
Real GDP...............................	2.8	3.6	4.1
Real GDI...............................	---	1.4	1.8
Current-dollar GDP....................	4.8	5.6	6.2
Gross domestic purchases price index...	1.8	1.8	1.8

Corporate Profits

Profits from current production (corporate profits with inventory valuation adjustment (IVA) and capital consumption adjustment (CCAdj)) increased $39.2 billion in the third quarter, compared with an increase of $66.8 billion in the second. Taxes on corporate income decreased $0.4 billion, in contrast to an increase of $10.0 billion. Profits after tax with IVA and CCAdj increased $39.5 billion, compared with an increase of $56.9 billion.

Dividends decreased $179.0 billion in the third quarter, in contrast to an increase of $273.5 billion in the second. The large third-quarter decrease primarily reflected dividends paid by Fannie Mae to the federal government in the second quarter. Undistributed profits increased $218.6 billion, in contrast to a decrease of $216.6 billion. Net cash flow with IVA -- the internal funds available to corporations for investment -- increased $231.1 billion, in contrast to a decrease of $205.3 billion.

BOX.

Profits from current production reflect the depreciation of fixed assets valued at current cost using consistent depreciation profiles. These profiles are based on used-asset prices and do not depend on the depreciation-accounting practices used for federal income tax returns. The IVA and CCAdj are adjustments that convert inventory withdrawals and depreciation of fixed assets reported on a tax-return, historical-cost basis to the current-cost economic measures used in the national income and product accounts.

Corporate profits by industry

Domestic profits of financial corporations increased $9.7 billion in the third quarter, compared with an increase of $24.5 billion in the second. Domestic profits of nonfinancial corporations increased $12.7 billion, compared with an increase of $37.8 billion. The increase in profits of financial corporations reflected increases in both Federal Reserve banks and "other" financial industries. The increase in nonfinancial corporations primarily reflected increases in manufacturing and in "other" nonfinancial corporations that were partly offset by a decrease in information. Within manufacturing, the largest increases were in "other" durable goods and in food and beverage and tobacco products. These increases were partly offset by decreases in petroleum and coal products and in chemical products.

The rest-of-the-world component of profits increased $16.7 billion in the third quarter, compared with an increase of $4.6 billion in the second. This measure is calculated as the difference between receipts from the rest of the world and payments to the rest of the world.

Gross value added of nonfinancial domestic corporate business

In the third quarter, real gross value added of nonfinancial corporations increased, and profits per unit of real value added increased. The increase in unit profits reflected an increase in unit prices that was partly offset by increases in both the unit nonlabor and labor costs incurred by corporations.

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* * *

Next release -- January 30, 2014, at 8:30 A.M. EST for:
Gross Domestic Product: Fourth Quarter and Annual 2013 (Advance Estimate)

* * *

Release dates in 2014

Gross Domestic Product

	2013: IV and 2013 annual	2014: I	2014: II	2014: III
Advance...	January 30	April 30	July 30	October 30
Second....	February 28	May 29	August 28	November 25
Third.....	March 27	June 25	September 26	December 23

Corporate Profits

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EPA AND THE CCS OOPS

We have previously aired our concerns about EPA relying on CCS as the legal justification for its proposed power plant CO2 rule , but we never saw this one coming. More to the point, neither, apparently, did EPA.

On November 15, House Energy and Commerce Chair Fred Upton and others sent EPA a letter pointing out that two separate laws limited using federally-assisted CCS projects as evidence that CCS meet a variety of Clean Air Act criteria. EPA's proposed rule relies on four coal-fired power plants with CCS (two proposed and two under construction) as justification for finding that CCS is the "best system of emissions reductions adequately demonstrated", the applicable standard in Section 111 of the Clean Air Act. Three of those plants (Kemper, the Texas Clean Energy Project, and the Hydrogen Energy California project) are subject to both of those laws (the fourth plant is in Canada) and, in short, EPA just lost ¾ of its factual basis for mandating CCS for new coal-fired power plants.

Both of these restrictions were enacted as part of the Energy Policy Act of 2005. The first applies to plants that get "Section 48A" tax credits for CCS, and provides that:

"No use of technology (or level of emission reduction solely by reason of the use of the technology), and no achievement of any emission reduction by the demonstration of any technology or performance level, by or at one or more facilities with respect to which a credit is allowed under this section, shall be considered to indicate that the technology or performance level is . . . adequately demonstrated for purposes of section 111 of the Clean Air Act." *Energy Policy Act of 2005 (Public Law 109-58) §1307(b); codified at 26 U.S.C. §48A(g).*

Uh-oh.

The second provision applies to plants that get Clean Coal Power Initiative funding from DOE:

"No technology, or level of emission reduction, solely by reason of the use of the technology, or the achievement of the emission reduction, by 1 or more facilities receiving assistance under this Act, shall be considered to be . . . adequately demonstrated for purposes of section 7411 of this title." *Energy Policy Act of 2005 (Public Law 109-58) §402(i); codified at 42 U.S.C. §15962(i).*

Phrased differently, this provision is less restrictive in that it says EPA may not rely "solely" on such plants as justification for deeming CCS to be "adequately demonstrated". Given the fourth plant in Canada, EPA does not rely "solely" on these three plants (just "mostly").

Our previous commentary noted that the only reason that EPA withdrew its first proposal for these standards was to replace its original legal justification for them with its "CCS is the "best system of emissions reductions adequately demonstrated" rationale. Most CAA aficionados thought EPA's original rationale (a highly technical issue dealing with "source categories") was more likely to survive judicial review than trying to persuade the D.C. Circuit that CCS was "adequately demonstrated". Now that EPA has apparently lost most of the factual basis for that determination, we think it has two choices: concede error, abandon the CCS rationale and return to the original justification, or double down and try to brazen this out. Interestingly, at the time of writing this (November 20) neither the notice withdrawing EPA's first version of the proposed rule (published back in April 2012), nor the CCS version has yet appeared in the Federal Register, despite the latter being signed on September 20.

More to come, undoubtedly.

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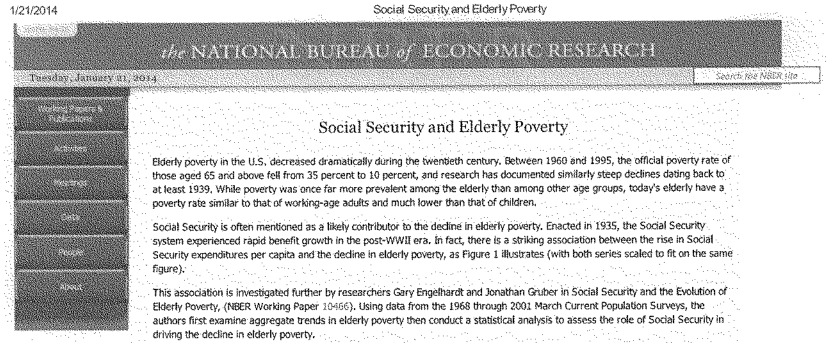
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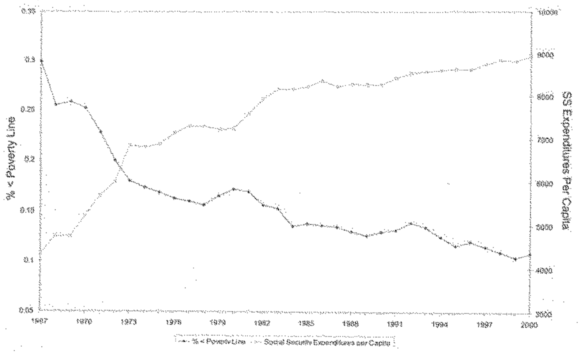
Social Security and Elderly Poverty

Elderly poverty in the U.S. decreased dramatically during the twentieth century. Between 1960 and 1995, the official poverty rate of those aged 65 and above fell from 35 percent to 10 percent, and research has documented similarly steep declines dating back to at least 1939. While poverty was once far more prevalent among the elderly than among other age groups, today's elderly have a poverty rate similar to that of working-age adults and much lower than that of children.

Social Security is often mentioned as a likely contributor to the decline in elderly poverty. Enacted in 1935, the Social Security system experienced rapid benefit growth in the post-WWII era. In fact, there is a striking association between the rise in Social Security expenditures per capita and the decline in elderly poverty, as Figure 1 illustrates (with both series scaled to fit on the same figure).

This association is investigated further by researchers Gary Engelhardt and Jonathan Gruber in Social Security and the Evolution of Elderly Poverty, (NBER Working Paper 10466). Using data from the 1968 through 2001 March Current Population Surveys, the authors first examine aggregate trends in elderly poverty then conduct a statistical analysis to assess the role of Social Security in driving the decline in elderly poverty.

Figure 1: Elderly Poverty and Social Security Expenditures over Time



The authors draw several interesting conclusions from their analysis of aggregate trends. First, when poverty is measured relative to median non-elderly income rather than relative to the official poverty line, the decline in elderly poverty ended in the early 1980s. Income inequality has increased markedly since then among the elderly and non-elderly alike. Second, poverty rates are strongly cyclical - rising during recessions and falling during economic expansions - for the non-elderly but not for the elderly, highlighting the protective effect of Social Security. Third, decreases in elderly poverty over time have been similar across age groups but larger for married couples than for other groups.

As the authors note, assessing the causal effect of Social Security on poverty is difficult. For example, individuals may work and save more when benefits are less generous, so a simple calculation of the increase in poverty that would result from eliminating Social Security income would likely overstate the true effect by ignoring these behavioral responses.

To avoid this problem, the authors construct a measure of Social Security benefits that depends only on the Social Security rules that apply to each birth cohort and not on workers' actual labor market experience. They examine the relationship between this measure and poverty rates for people born between 1880 and 1935. For some of the analysis, the authors focus on a narrower range of birth cohorts, making use of the sharp drop in benefits experienced by the "notch" cohorts of 1917-1921.

The authors estimate that a $1,000 increase in Social Security benefits is associated with a 2 to 3 percentage point reduction in poverty rates for elderly households. They also find no statistically significant effect of benefits on income inequality, suggesting that higher-income and lower-income elderly benefit similarly from increases in Social Security.

Applying this estimate to the change in Social Security benefits between 1967 and 2000 suggests that the increase in benefits can explain all of the 17 percentage point decline in poverty that occurred during this period. The authors also find that higher benefits lead some elderly to live independently rather than with family members, and conclude that the effect of Social Security on poverty would have been even more dramatic in the absence of these changes in living arrangements.

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RESEARCH ARTICLE
10.1002/2013EF000165

An apparent hiatus in global warming?

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Abstract Global warming first became evident beyond the bounds of natural variability in the 1970s, but increases in global mean surface temperatures have stalled in the 2000s. Increases in atmospheric greenhouse gases, notably carbon dioxide, create an energy imbalance at the top-of-atmosphere (TOA) even as the planet warms to adjust to this imbalance, which is estimated to be 0.5–1 W m^{-2} over the 2000s. Annual global fluctuations in TOA energy of up to 0.2 W m^{-2} occur from natural variations in clouds, aerosols, and changes in the Sun. At times of major volcanic eruptions the effects can be much larger. Yet global mean surface temperatures fluctuate much more than these can account for. An energy imbalance is manifested not just as surface atmospheric or ground warming but also as melting sea and land ice, and heating of the oceans. More than 90% of the heat goes into the oceans and, with melting land ice, causes sea level to rise. For the past decade, more than 30% of the heat has apparently penetrated below 700 m depth that is traceable to changes in surface winds mainly over the Pacific in association with a switch to a negative phase of the Pacific Decadal Oscillation (PDO) in 1999. Surface warming was much more in evidence during the 1976–1998 positive phase of the PDO, suggesting that natural decadal variability modulates the rate of change of global surface temperatures while sea-level rise is more relentless. Global warming has not stopped; it is merely manifested in different ways.

Key Points:

- There is a hiatus in the rise in global mean surface temperatures over the past decade
- Global warming continues but manifested in different ways
- Natural variability is playing the major role in the hiatus, through the PDO

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1. Introduction

How often have we heard "Wow it's cold, where is global warming?" How can we get a cold and snowy winter with anthropogenic climate change? Most people recognize from their own experience that we have weather in all its infinite and wonderful variety, so that there are large variations in temperature and precipitation from day-to-day and week-to-week. The biggest climate change we experience is the one from summer to winter, or from winter to summer, or in the tropics from the wet monsoon season to the dry "winter monsoon." We expect these changes and even look forward to them. Our planting and harvesting of crops depend on them. Yet every summer is different, and so is every winter. There are "regimes" of climate where one summer may be sunny, dry, and hot, whereas another may be cool, cloudy, and wet. Globally, the biggest cause of such regimes that last several seasons is the El Niño-Southern Oscillation (ENSO) phenomenon. Since the major 1997/1998 El Niño event that affected weather patterns around the world, the term "El Niño" has become part of the public vernacular and not just a scientific term. Yet somehow, when talking about human-induced climate change, often referred to as "global warming," the idea that it is not relentless but rather occurs along with natural fluctuations from ENSO, weather, and other modes of variability has often been lost.

The 2000s are by far the warmest decade on record (Figure 1). Before then the 1990s were the warmest decade on record. Since global warming really reared its head in the 1970s in the sense that the global warming signal emerged from the noise of natural variability, every decade has been warmer than the previous ones and increasing evidence suggests that the past few decades are warmer than any others in the past 2000 years [*IPCC*, 2007]. However, there has been a slowing in the rise of global mean temperature over the past decade, often referred to as a hiatus or plateau. Has global warming stalled? Or is it entirely expected that natural variability rears its head and can offset warming for a decade or two?

In part the answer depends on what we mean by "global warming." For many it means the global mean temperature increases. But for anthropogenic climate change, it means the climate change resulting from all kinds of human activities, and it is now well established that by far the biggest influence occurs from changes in atmospheric composition, which interfere with the natural flow of energy through the climate system [*IPCC*, 2007]. Referred to as "radiative forcing" by scientists, the biggest effect comes from increasing carbon dioxide in the atmosphere because carbon dioxide is a greenhouse gas (GHG) (Figure 1) [*IPCC*,

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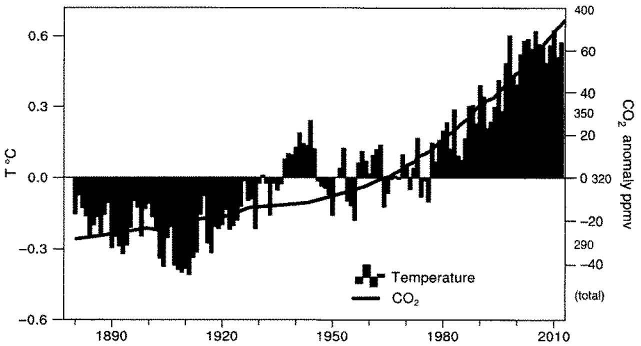

Figure 1. Estimated changes in annual global mean surface temperatures (°C, color bars) and CO_2 concentrations (thick black line) since 1880. The changes are shown as differences (anomalies) from the 1901 to 2000 average values. Carbon dioxide concentrations since 1957 are from direct measurements at Mauna Loa, Hawaii, whereas earlier estimates are derived from ice core records. The scale for CO_2 concentrations is in parts per million (ppm) by volume, relative to a mean of 320 ppm, whereas the temperature anomalies are relative to a mean of 13.9°C (57°F).

2007]. Preindustrial values are estimated to average about 280 ppmv (parts per million by volume) but values in 2013 have exceeded 400 ppmv, a 43% increase, mainly from the burning of fossil fuels. Several other GHGs (methane, nitrous oxide, and chlorofluorocarbons) have also increased from various human activities, while tiny particulates (aerosols) in the atmosphere can cause both warming by absorbing radiation or cooling by scattering and reflecting radiation back to space. The result is a positive (down) energy imbalance at the top-of-atmosphere (TOA). In that sense "global warming" really means global heating. Increasing global mean temperature is but one manifestation of the effects [*Trenberth et al.*, 2009] (K. E. Trenberth et al., Earth's energy imbalance, submitted to *Journal of Climate*, 2013, hereinafter referred to as Trenberth et al., submitted manuscript, 2013).

There are numerous other human effects that contribute to climate change, but most of the others are of importance only regionally: building "concrete jungles" known as cities which have an urban heat island effect, other changes in land use and land cover, irrigation, space heating, and so on. Humans also contribute substantially to regional changes in aerosols, which in turn influence clouds (the indirect effect), and these aerosols vary rapidly in time as they are washed out and interact with weather systems. Hence, they have a short lifetime in the atmosphere and their influence is mainly near their source. Their variations over the past few decades are not well known and they are not considered further here. There are also natural radiative forcings of the climate system, especially those related to Sun-Earth geometry and the Earth's orbit. But on century or less time scales the main ones of importance are changes in the Sun and natural aerosols, especially those resulting from explosive volcanic eruptions, which have a lifetime of a few years in the stratosphere.

With a global energy imbalance due to increased trapping of outgoing longwave radiation by GHGs, which is estimated to be 0.5–1 W m^{-2} in the 2000s [*Trenberth et al.*, 2009; *Hansen et al.*, 2011] (Trenberth et al., submitted manuscript, 2013), the energy can go various places [*Trenberth and Stepaniak*, 2004]. The incoming energy is radiant energy and it can be transformed into internal energy (related to temperature), potential energy (related to gravity and altitude), kinetic energy (related to motion), latent energy (related to changes in phase of especially water), and even chemical energy and formation of "fuel." Indeed, some energy goes into melting Arctic sea ice, which has decreased by more than 40% in late summer since the 1970s, melting of glaciers and ice sheets such as Greenland, heating the land and the atmosphere, heating the oceans, and in driving changes in the hydrological cycle. The warming oceans expand and, along with the extra water from melting land ice, lead to rising sea levels at a

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global rate of 3.2 mm/yr from 1992 to 2012 [updated from *Nerem et al.*, 2010]. Increases in evaporation and associated increases in atmospheric humidity in the warmer atmosphere can change storms and clouds and thus the albedo, and therefore feedback and change both the incoming and outgoing radiation because water vapor is a powerful GHG. More than 90% of the associated energy imbalance goes into the oceans [*IPCC*, 2007; *Trenberth*, 2009; *Trenberth and Fasullo*, 2010] (Trenberth et al., submitted manuscript, 2013).

Carbon dioxide concentrations continue to increase (Figure 1) and along with them there is a steady increase in radiative forcing on the order of 0.3 W m^{-2} per decade [*IPCC*, 2007]. In the past decade, this rise is offset somewhat between 2005 and 2010 by reduced solar irradiance during a period of low sunspot activity on the order of 0.1 W m^{-2} [*Trenberth*, 2009] (Trenberth et al., submitted manuscript, 2013), and perhaps by changes in atmospheric aerosols and stratospheric water vapor [*Solomon et al.*, 2010, 2011] also on the order of 0.1 W m^{-2}. Nevertheless, one issue is how the radiative forcing is changing and what the expectations should be for our changing climate.

In this article, we explore surface temperature variations and the cause of the apparent hiatus in warming, such as it is, in more detail and the relationship with ENSO and decadal variability. We further explore the recent changes in the ocean.

2. Global Mean Surface Temperatures

Global mean temperatures have been reconstructed by several groups over the past century or longer (Figure 2). They also result from global analyses of all variables, such as the ECMWF (European Centre for Medium-Range Weather Forecasts, Reading, England) reanalysis called ERA-Interim (ERA-I) [*Simmons et al.*, 2010]. In spite of the agreement globally, there are some differences among global land and global ocean values. *Simmons et al.* [2010] show, using ERA-I, how missing data over land, and especially the Arctic, lead to underestimates of recent trends in the HADCRU dataset. However, ERA-I has an inhomogeneity in the sea surface temperature (SST) record owing to a switch in sources of information, leading to spuriously cooler values after about 2000, whereas the HADCRU4 data [*Morice et al.*, 2012] have larger SST trends [*Simmons et al.*, 2010]. The Goddard Institute for Space Studies (GISS) [*Hansen et al.*, 2010] values lie in between ERA-I and HADCRU4 estimates in both domains. The NOAA National Climatic Data Center (NCDC) analysis is a blend of land data from the Global Historical Climate Network (GHCN) [*Lawrimore et al.*, 2011] with the ERSST3b [*Smith et al.*, 2008].

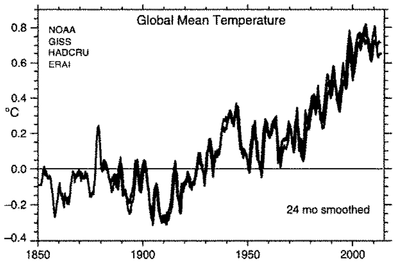

Figure 2. Global mean temperature time series as 24 month running means from several sources: NOAA NCDC, GISS, HADCRU3, and ERA-I. ERA-I was offset by 0.54°C. Here the base period is 1900–1949.

We use the NOAA time series in Figure 1 and explore the seasonality of the trends in Figure 3. In Figures 1 and 2, we note the overall rising global mean temperatures after the 1960s but with a slowing rate in the 2000s. Figure 1 also shows the annual anomalies in carbon dioxide from NOAA scaled to suggest a relationship with global mean temperature, because it is readily demonstrated using climate models that such a relationship exists [*IPCC*, 2007]. However, carbon dioxide has continued to rise, along with other GHGs, and the radiative forcing is increasing steadily. While the lack of agreement between the two time series in Figure 1 is readily apparent from year to year and even from decade to decade, it is desirable to understand why and how the two deviate from each other.

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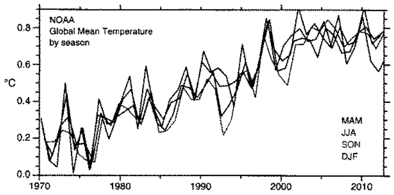

Figure 3. NOAA global mean temperature anomalies after 1970 for the four seasons: DJF, MAM, JJA, and SON.

Examining the seasonality of the global mean temperatures (Figure 3) reveals that the biggest hiatus in warming is in the northern winter season (December-January-February, DJF) owing to a few quite cold winters, especially 2008 and 2012 [*Cohen et al.*, 2012]. Yet such winters were not that cold in the overall longer-term context, although very cold spots occurred locally such as in Europe. Some rather unusual atmospheric circulation patterns were responsible in Europe: strong negative values of the North Atlantic Oscillation (NAO) (discussed more later; Figure 7) especially in the northern winter of 2009–2010, which featured exceptionally low values of the NAO over an extended period. *Cohen et al.* [2012] instead refer to the "Arctic Oscillation" as the atmospheric mode associated with the cooling in Eurasia, but this is strongly correlated with the NAO [*Trenberth et al.*, 2007].

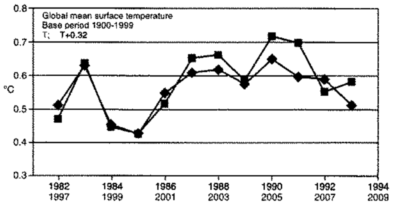

Figure 4. NOAA annual global mean temperature anomalies for 1982–1994 increased by 0.32°C (red) and from 1997 to 2009 (blue).

Even in the last three decades we can ask whether such slowdowns have occurred before, and Figure 4 shows the 11 years beginning 1982 and 1997 in detail, showing a remarkable resemblance in subsequent evolution. It so happens that 1982–1983 and 1997–1998 were the times of the two biggest El Niños on record, and it is well established that a mini global warming occurs at the latter stages of an El Niño as heat comes out of the upper ocean and contributes to a warmer atmosphere and surface—but resulting in a cooler ocean [*Trenberth et al.*, 2002] (Trenberth et al., submitted manuscript, 2013). Even so, the eruptions of El Chichón in March to April 1982 and Mount Pinatubo in June 1991 no doubt also influenced these time series.

Before exploring this aspect further, an examination of meridional profiles (Figure 5) shows the biggest warming in the Arctic where record low sea ice has been reported in several recent years. It is mainly from 20° to 65° latitude in both hemispheres where the slowdown has occurred, although this figure is adversely affected for the ocean by the spurious lower SSTs after about 2000 in the ERA-I analysis. This affects the Southern Hemisphere in particular.

3. Sources of Variability

3.1 ENSO

The biggest fluctuations in global mean surface temperature have been identified with ENSO [e.g., *Trenberth et al.*, 2002]. Figure 6 presents the global mean surface temperature as a 12 month running mean of anomalies after 1970 and it reveals that a linear trend is actually a pretty good fit. The huge warming in 1998 from the 1997 to 1998 El Niño is evident, and to emphasize the relationships between the interannual variability and ENSO, the duration of each El Niño and La Niña event, as given by NOAA's Oceanic Niño Index (ONI), is also marked on the figure along with the actual time series of the Niño3.4 SSTs on which the ONI is based. The latter indicates the magnitude of each event. The relationship between ENSO and global mean temperatures is well established [*Trenberth et al.*, 2002] and has been used by several studies to linearly "remove" the ENSO effects using linear regression [*Lean and Rind*, 2008, 2009; *Foster and Rahmstorf*, 2011]. These studies show that ENSO accounts for short-term fluctuations in

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global surface temperature with a range of up to 0.39°C and a regression of global mean temperature on the Niño3.4 index gives values of 0.1°C per standard deviation with a 3 month lag [*Trenberth et al.*, 2002]. Once ENSO is removed, the residual global mean temperature time series is remarkably linear after 1970, with no evidence of a hiatus, highlighting the role of natural variability in the global mean temperatures. These studies have also used simple techniques to remove volcanic and solar signals. There have been no major volcanic eruptions since Mount Pinatubo in 1991 although smaller events may contribute a little (order 0.1 W m^{-2}) to reduced radiative forcing [*Solomon et al.*, 2011]. Solar variations occur with the sunspot cycle and are of the order of 0.15 W m^{-2} peak to peak (Trenberth et al., submitted manuscript, 2013). They contribute somewhat to reduced radiative forcing over the past decade especially from 2003 to 2009 but the Sun is now more active again.

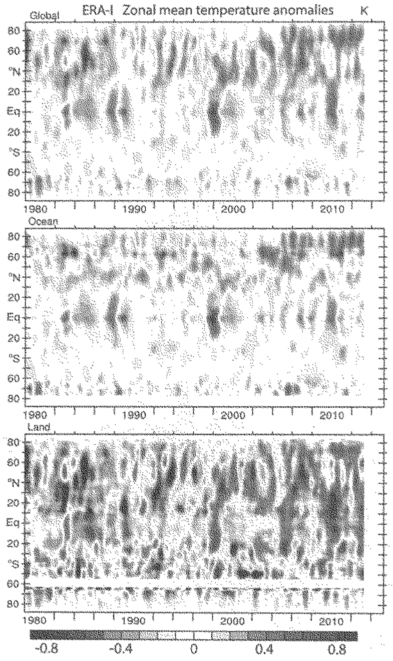

Figure 5. ERA-I zonal mean temperature anomalies weighted by cos(ϕ), where ϕ is latitude, smoothed with a 13-term low-pass filter; top: global; middle: ocean; and bottom: land. The base period is January 1979 to December 2012.

Trenberth et al. (submitted manuscript, 2013) examined variations in the TOA energy imbalance in eight ensemble members of the Community Climate System Model version 4 (CCSM4) climate model and found standard deviations of monthly means about an ensemble mean of 0.62 W m^{-2}, reducing to 0.25 W m^{-2} for 12 month running means. The high level of month-to-month variability is similar to that observed at the TOA by the CERES (Clouds and the Earth's Radiant Energy System) instrument and suggests that cloud fluctuations associated with weather are a nontrivial source of energy imbalance fluctuations. However, they also average out fairly quickly, leaving ENSO and decadal variability as a source of lower-frequency fluctuations.

3.2 Decadal Variability

While the ENSO interannual variations are reasonably well known, the decadal variations are not. Prominent decadal variability occurs in both the Atlantic and Pacific Oceans: the Atlantic Multidecadal Oscillation (AMO) and the Pacific Decadal Oscillation (PDO) and associated Interdecadal Pacific Oscillation (IPO) (see *Trenberth et al.* [2007] for reviews and depictions of the associated patterns and time series). The NAO also varies on multiple time scales but is most important in the northern winter months of December through March. *Wu et al.* [2011] used empirical statistical methods to suggest that natural variability has played a significant role in decadal variations in global mean temperatures. Using CMIP3 model simulations of the 20th century, *DelSole et al.* [2011] partitioned the global temperature into an anthropogenic component and a natural component attributed to atmospheric-ocean interactions and, in particular, to

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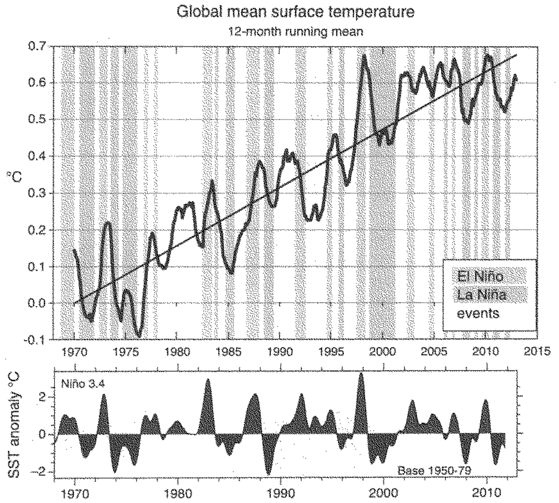

Figure 6. The NOAA global mean 12 month running mean surface temperatures are given relative to 1901–2000 along with a linear trend fit. Marked on the graph are the El Niño (buff) and La Niña (sky blue) periods as defined by NOAA's ONI, based on the Niño 3.4 SST anomalies, as given in the lower panel relative to a base period of 1950–1979.

the AMO. However, these results depend on the fidelity of models and the forcings used, and the latter are not well known, especially for aerosols.

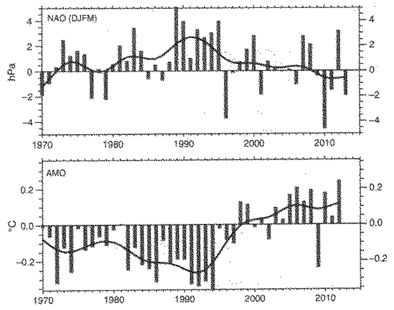

Figure 7. Time series of values of the NAO in northern winter (DJFM) and annual mean AMO along with a low-pass (13-term) decadal filter used in IPCC [*Trenberth et al.*, 2007]. For AMO the units are K and for NAO the units are hPa.

The NAO index (Figure 7) depicts the strength of the westerlies from the North Atlantic into Europe and correlates well with temperatures in Eurasia and inversely with those over Greenland, as well as precipitation as a north-south dipole over Europe: wet in the north and dry in the south in the positive phase. The winter (December through March) station-based index of the NAO [*Hurrell*, 1995] is based on the difference of normalized sea-level pressure (SLP) between Lisbon, Portugal, and Stykkisholmur/Reykjavik, Iceland, since 1864 in hectopascal (hPa); http://climatedataguide.ucar.edu/guidance/hurrell-north-atlantic-oscillation-nao-index-station-based. The NAO is important in the northern extratropics in winter [*Hurrell*, 1996] where it accounted for 31% of the 20°N–90°N

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surface temperature variance for 1935–1994 for DJFM, but subsequently NAO has not gone hand-in-hand with global temperature and there is no significant correlation overall.

The AMO is a measure of SSTs in the North Atlantic, north of the equator, relative to the global mean [*Trenberth and Shea*, 2006]. The recent post-1970 variations in the AMO and NAO (Figure 7) show indeed that variability is quite large. Note that in terms of global mean temperature, the scale on Figure 7 would be reduced by the ratio of the area of the North Atlantic to the global area, which is 7.3%.

The PDO has been identified with changes in SLP over the North Pacific [*Trenberth and Hurrell*, 1994]. Often it is defined by using SSTs in the Pacific [*Mantua et al.*, 1997] using 110°E to 100°W, 20°N to 70°N as a core region, with the global mean SSTs removed, to compute the first empirical orthogonal function (EOF) pattern and associated time series, and then regress the time series with SSTs over the entire globe (Figure 8). This is a new analysis (courtesy of Adam Phillips; cf. *Deser et al.* [2004]) and the EOF accounts for 25% of the monthly anomaly variance of SST for the period 1900 to May 2013, using the HADISST dataset. *Chen et al.* [2008] provide an alternative derivation of Pacific decadal variability that shows how robust it is to different approaches. They also note how similar many aspects of the pattern are to ENSO but that the PDO does not account for changes in global mean surface temperature owing to large regional cancellations.

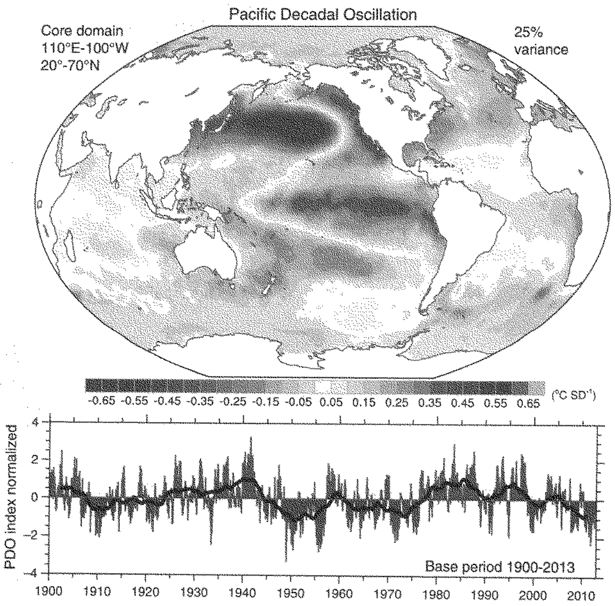

Figure 8. The Pacific Decadal Oscillation based on an EOF analysis of SST anomalies with the global mean removed from 1900 to May 2013 in the 20°N–70°N and 110°E–100°W region of the North Pacific, which explains 25% of the variance. The principal component time series, given below in normalized units, is regressed on global SSTs to give the map above. The black curve is a 61 month running average.

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Deniers of climate change often cherry-pick points on time series and seize on the El Niño warm year of 1998 as the start of the hiatus in global mean temperature rise (Figure 6). This turns out, arguably, to have been the transition time from a positive to a negative phase of the PDO. The monthly time series (Figure 8) readily reveals the multidecadal regimes of the PDO (given by the black line) with positive phases from 1923 to 1942 and 1976 to 1998, and negative phases from 1943 to 1976 and after 1999. While naturally emphasizing the North Pacific, the pattern covers the entire Pacific with a somewhat ENSO-like pattern but one that is broader in the tropics [*Chen et al.*, 2008].

If we now examine the hiatus period of 1999–2012 and compare it to the time when global warming really took off from 1976 to 1998 (Figure 9), the negative PDO pattern emerges very strongly throughout the Pacific although warming prevails in the Atlantic and Indian Oceans and on land. In other words, it is the central and eastern Pacific more than anywhere else that has not warmed in the past decade or so. In spite of some cold European winters, Europe does not standout in Figure 9 and instead is a warm region. The AMO is positive (Figure 7) and is revealed in Figure 9 to be part of a wider warming.

One approach to estimating ocean heat content (OHC) changes is by combining the available observations (surface, ocean, and from space) with an ocean model to produce a dynamically consistent ocean analysis. The new ORAS-4 ocean reanalysis from ECMWF has revealed very distinctive climate signatures that are realistic in magnitude and duration in terms of changes in OHC [*Balmaseda et al.*, 2013] (Trenberth et al., submitted manuscript, 2013). Figure 10 shows the five ensemble members of the ORAS-4 ocean reanalysis OHC for 0–700 m and full-depth ocean and reveals the increased heating below 700 m depth of 0.21 W m^{-2} globally after 2000. The orange bars show the times of the El Chichón and Pinatubo volcanic eruptions when sharp drops occurred in OHC that quantitatively match estimates of TOA radiative changes (such as in Pinatubo) [*Trenberth and Dai*, 2007], as demonstrated in a new analysis by Trenberth et al. (submitted manuscript, 2013). ORAS-4 also reveals a major cooling of the tropical Pacific Ocean in association with the 1997–1998 El Niño event. Following this, the ocean warmed at a startling rate of over 1.2 W m^{-2} from the 2000s for the global ocean (or 0.84 W m^{-2} for the global area), and the overall heating is estimated to be 0.91 W m^{-2} globally when melting sea ice and other components are included as well [*Balmaseda et al.*, 2013] (Trenberth et al., submitted manuscript, 2013). More than 30% of the heat was deposited into the ocean below 700 m in an unprecedented fashion in the post 2000 record from ORAS-4 and was identified mainly with changes in the tropical and subtropical winds in the Pacific.

Figure 11 shows the regime changes for 1999–2012 versus 1979–1998 from the ERA-I reanalysis for SLP and surface winds. Reanalysis winds and surface fluxes, bias corrected, were used to drive the ocean in

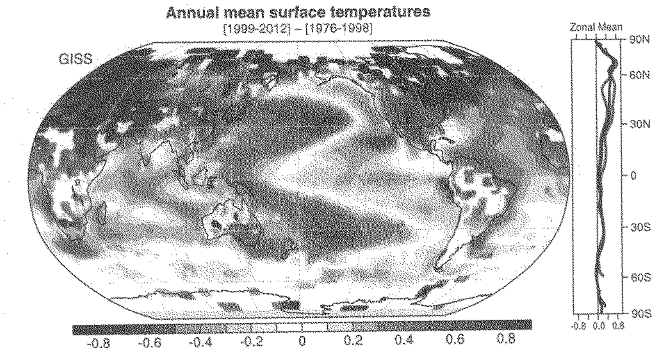

Figure 9. Mean annual surface temperature differences from GISS for 1999–2012 and 1976–1998 in °C, with zonal means at right for ocean (blue), land (red), and zonal mean (black).

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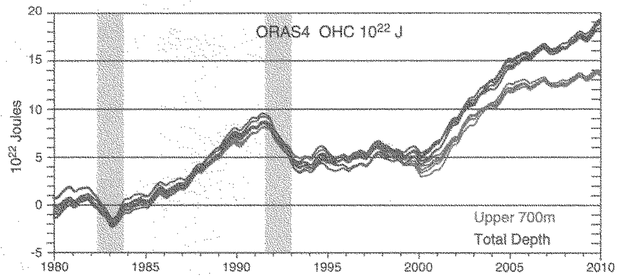

Figure 10. The five ensemble members of the ORAS-4 ocean reanalysis OHC for 0–700 m and full-depth ocean are shown, where they have been aligned for 1980 to 1985, in 10^{22} J. The increased heating below 700 m of about 0.2 W m^{-2} globally is revealed after about 2000. The orange bars show the times of the El Chichón and Pinatubo volcanic eruptions.

ORAS-4 during the assimilation to result in the OHC fields in Figure 12. Figure 11a reveals the very strong changes toward higher pressures over the cool central and eastern Pacific especially in the subtropics and the much stronger than normal tradewinds by more than 1 m s^{-1} in the vicinity of the equator from 15°N to 15°S, 150°E to 150°W, and in the subtropics farther east (160°W to 110°W). The SST pattern of change is reflected in the OHC changes down to 700 m (Figure 12) signifying the extra heat storage in the tropical western Pacific and deeper thermocline, but with much cooler conditions throughout the eastern Pacific from 30°N to 30°S. Variability in the surface wind field is independently corroborated by changes in sea level based on both the altimetry and gauge records as the easterly anomalous winds have driven a "piling up" of water in the western Pacific Ocean. Because of this effect, some regions in the western Pacific have experienced sea-level rise at three times the rate of the global ocean in recent decades. The length of the gauge record provides an extended record over which this regional increase can be linked to the PDO [*Merrifield et al.*, 2012].

Figure 11b presents the northern polar view of the same changes in Figure 11a to highlight the relationships of the apparent wavelike structure extending northward from the Pacific, across the pole into Europe. This aspect is likely better seen in the upper troposphere as a quasi-stationary Rossby wave [*Ineson and Scaife*, 2009], an aspect to be pursued elsewhere. Nonetheless, it is very suggestive of a relationship with the NAO in its negative phase. This also highlights the influence of the changes in the Pacific with the high latitudes of both hemispheres, the extension to the North Atlantic in the Northern Hemisphere and to the Southern Oceans in the Southern Hemisphere (Figure 11a), where the wave structure relates to changes in Antarctic sea ice.

These kinds of changes have been independently simulated in hiatus periods in warming scenarios of the 21st century in the CCSM4 [*Meehl et al.*, 2011, 2013] in association also with negative PDO (or IPO) periods and more frequent La Niña events. They are identified with a stronger wind-driven overturning in the Pacific, with upwelling near the equator and subsiding waters in the subtropics, leading to the buildup in heat off the equator in the western and central Pacific.

So what about the cold northern winters in the 2000s that have been associated with the strong negative phase of the NAO? In Figure 7 the NAO reveals some low-frequency variability that appears to be in phase with the PDO variations (Figures 11b and 13). Given the global nature of the atmosphere it is not surprising that links between the Pacific and Atlantic Oceans form at times, but these modes are not inherently coupled. Low-frequency variability in NAO and links to ENSO are discussed by *Ineson and Scaife* [2009] who note the important role of the global teleconnection pathway from the Pacific region via the stratosphere. Moreover, small effects from the Sun in the ultraviolet from the lower stratosphere can be amplified [*Ineson et al.*, 2011]. Together, the PDO, AMO, and NAO account for a lot of the regional and seasonal climate changes going on. While these are the predominant natural modes of variability, it is quite

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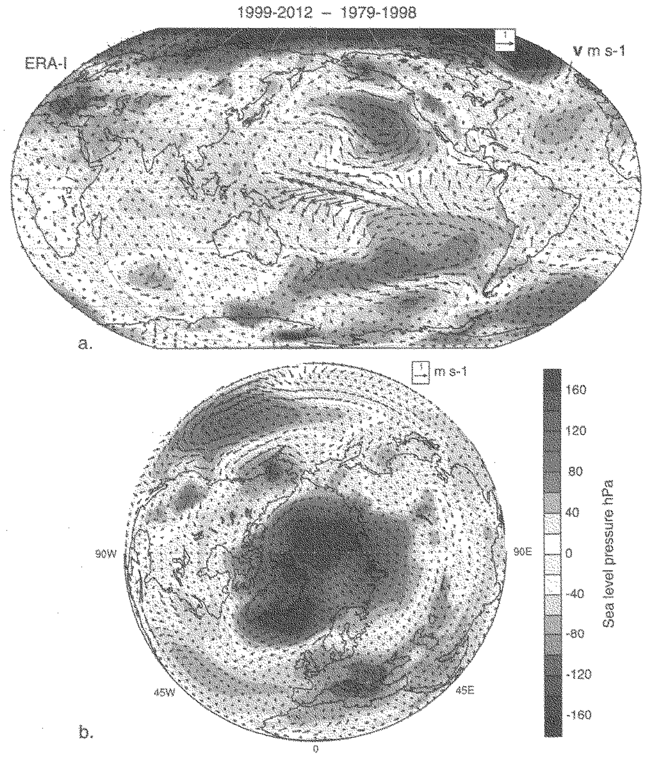

Figure 11. Mean annual sea-level pressure differences from ERA-I for 1999–2012 and 1976–1998 in hPa (colors) and for surface wind vectors (arrows) in m s^{-1} with the key at top right. (a) Map projection centered on the Pacific and (b) polar stereographic projection of the Northern Hemisphere.

possible, if not likely, that aspects of global climate change are manifested through changes in frequency of such modes [*Palmer*, 1999].

4. Conclusions

The picture emerging is one where the positive phase of the PDO from 1976 to 1998 enhanced the surface warming somewhat by reducing the amount of heat sequestered by the deep ocean, while the negative phase of the PDO is one where more heat gets deposited at greater depths, contributing to the overall warming of the oceans but cooling the surface somewhat. The Pacific Ocean appears to account for the majority of the decadal variability [*Chen et al.*, 2008]. Nevertheless, the events in the Pacific undoubtedly

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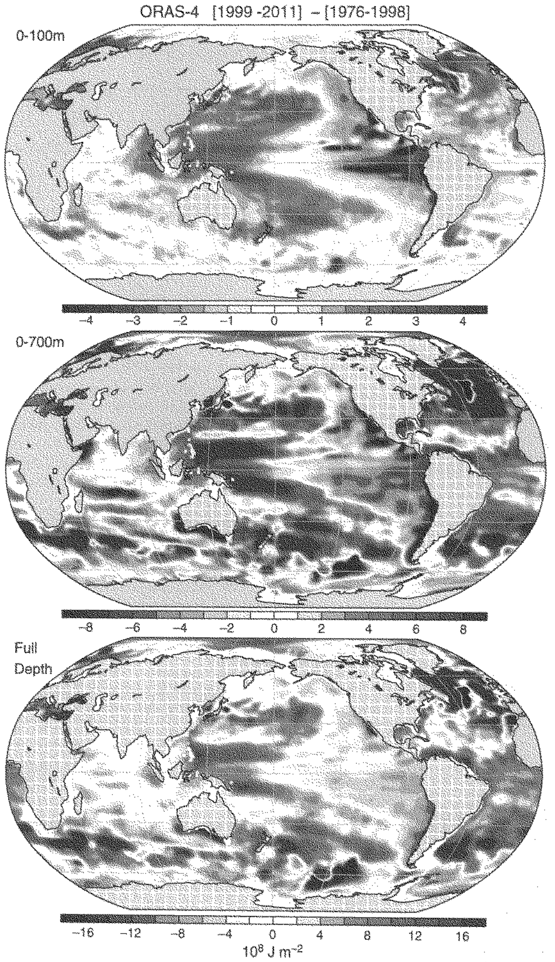

Figure 12. From ORAS-4 OHC differences for 1999–2012 and 1976–1998 in 10^8 J m^{-2} for the (top) 100 m, (middle) 0–700 m, and (bottom) full ocean depth. Note the different color keys for each figure.

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also affect the Atlantic, Indian, and Southern Oceans as the system acts collectively to equilibrate to these changes in the flow of energy.

Kosaka and Xie [2013] have very recently performed some novel experiments that highlight the important role of the PDO in the apparent hiatus in global mean surface temperatures. They used a climate model with radiative forcing and prescribed SSTs over the central and eastern Pacific Ocean. Yet they were able to reproduce many aspects of the observed changes from 1970 to 2012, including the changes in global mean temperature and the recent pause in warming, and several regional and seasonal aspects. Accordingly, the key indeed seems to lie in the Pacific and the decadal tendency for more La Niña events (associated with Pacific decadal variability), as suggested by *Meehl et al.* [2011, 2013]. However, *Kosaka and Xie* [2013] did not deal with why the SSTs have changed as observed.

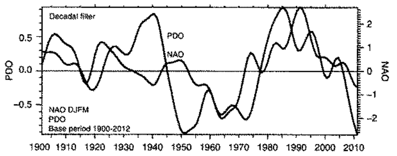

Figure 13. The decadal filtered PDO and NAO (DJFM).

We can speculate that the huge 1997–1998 El Niño event was a trigger for the change in the PDO; certainly, it led to a large loss of heat in the Pacific [*Balmaseda et al.*, 2013] that has taken years to recover from, if the recovery is even complete. Past behavior of the PDO (Figure 8) suggests that regimes can last for 25 years. The CCSM4 model has hiatus periods up to about 15 years in duration, projected during the 21st century when there is a positive TOA energy imbalance [*Meehl et al.*, 2013]. Accordingly, it becomes very important for climate models to be able to simulate ENSO and Pacific decadal variability realistically, with the correct amplitude and duration as a form of natural climate noise in which any external signals are embedded.

Variations in climate forcings are important, especially when major volcanic eruptions occur and reverberations are felt for years. Natural variations in clouds, changes in the Sun, and increases in minor volcanic eruptions may have accounted for up to a 20% reduction in radiative forcing and TOA energy imbalance in part of the 2000s but the Sun has now recovered and is now a factor in increased warming (Trenberth et al., submitted manuscript, 2013). The changes in external forcings are not obvious in the CERES TOA observations (Trenberth et al., submitted manuscript, 2013). Hence, although important, the variations in natural external forcings are not an explanation of the hiatus, but rather internal variations within the climate system are keys.

Expectations for the response from an energy imbalance come from climate models, and rely on realistic simulations of variability on all time scales. Many models have difficulty in simulating ENSO, although ENSO amplitude is actually too large in the CCSM4 model. But the veracity of decadal variability in models is an issue. Climate sensitivity estimates are greatly impacted by such variability especially when the observed record is used to try to place limits on equilibrium climate sensitivity [*Otto et al.*, 2013], and simply using the ORAS-4 estimates of OHC changes in the 2000s instead of those used by Otto et al., so that the entire system uptake changes from 0.65 to 0.91 W m^{-2}, changes their computed equilibrium climate sensitivity from 2.0°C to 2.5°C, for instance. Using short records with uncertain forcings of the Earth system that is not in equilibrium does not (yet) produce reliable estimates of climate sensitivity.

The PDO is essentially a natural mode of variability, although there are questions about how it is affected by the warming climate, and so the plateau in warming is not because global warming has ceased. The evidence supports continued heating of the climate system as manifested by melting of Arctic sea ice and glaciers, as well as Greenland, but most of the heat is going into the oceans and increasingly into the deep ocean, and thus contributes to sea-level rise. The analysis in this article does not suggest that global warming has disappeared; on the contrary, it is very much alive but being manifested in somewhat different ways than a simple increase in global mean surface temperature.

Acknowledgments
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Federal Climate Change Funding from FY2008 to FY2014

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CRS REPORT
Prepared for Members and
Committees of Congress

Summary

Direct federal funding to address global climate change totaled approximately $77 billion from FY2008 through FY2013. The large majority—more than 75%—has funded technology development and deployment, primarily through the Department of Energy (DOE). More than one-third of the identified funding was included in the American Recovery and Reinvestment Act of 2009 (P.L. 111-5). The President's request for FY2014 contains $11.6 billion for federal expenditures on programs. In the request, 23% would be for science, 68% for energy technology development and deployment, 8% for international assistance, and 1% for adapting to climate change. The Office of Management and Budget (OMB) also reports that energy tax provisions that may reduce greenhouse gas (GHG) emissions would reduce tax revenues by $9.8 billion.

At least 18 federal agencies administer climate change-related activities, according to OMB. Federal policy on climate change has been built largely from the "bottom up" from a variety of existing programs and mandates, presidential initiatives, and congressionally directed activities; funding has largely reflected departmental missions and support for each activity. Recently, the Obama Administration, in the context of its Climate Action Plan announced in June 2013, outlined an overall strategy with programs, resources, and tax incentives in a cross-agency, intergovernmental initiative. The new Climate Action Plan and a recent OMB report required by Congress on federal funding for climate change activities outline four main components of the strategy:

- Climate and Global Change Research and Education
- Reducing Emissions through Clean Energy Investments and Standards
- International Leadership
- Climate Change Adaptation

Possible Funding-Related Issues for Congress

Some Members of Congress have expressed interest in how federal funding may reflect and enable the Obama Administration's overall strategy, and priorities within it, to address climate change. Legislative issues regarding the federal funding of climate change activities may include the following:

- the sufficiency and alignment of federal resources to support a strategy to achieve long-term climate change policy goals;
- the demands of climate change adaptation programming for federal agencies, their programs, and resources;
- whether additional and predictable foreign aid resources may be provided to support actions by low-income countries to mitigate greenhouse gases or adapt to climate change;
- possible legislative proposals to restructure or improve collaboration among agencies regarding climate change activities;
- the incorporation of recommendations from evaluations (whether internal or external) to improve climate change programs; and

- possible requirements for reporting to Congress of funding, budget justifications, and programmatic progress that are adequate to support congressional decision-making and oversight.

Scope and Purpose of This Report

This report summarizes direct federal funding identified as climate change-related from FY2008 enacted funding through FY2013 and the FY2014 request (as well as a less consistent series beginning with FY2001). It reports the Administration's estimates of tax revenues not received due to energy tax provisions that may reduce GHG emissions. The report briefly identifies the programs and funding levels, as well as some qualifications and observations on reporting of federal funding. It further offers some issues that Members may wish to consider in deliberating on U.S. climate change strategies.

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Introduction

The federal government has funded work to address global climate change for more than four decades. An initial focus on science has expanded to encompass both mitigation and adaptation, involving at least 18 agencies plus the Executive Office of the President. The work supported is conducted by universities, national laboratories, private contractors, non-governmental organizations, and some federal agencies. Most of the funding has supported scientific and, since the 1990s, technological research and development (R&D).

Given uncertainties regarding the risks of future climate change, the federal climate strategy has aimed at improving the information available for decision-making and reducing the costs of technologies that could help abate the risks. A growing component has been federal planning and efforts to adapt to climate change. Complementing the science and technology initiatives have been regulatory actions;[1] programs to build capacity in private, state, local, and international entities to address climate change; and tax incentives to stimulate deployment of low greenhouse gas-emitting technologies. Many of these initiatives are identified in the Obama Administration's recently announced Climate Action Plan, which stated three main prongs:[2]

- cutting carbon pollution in America;
- preparing the United States for the impacts of climate change; and
- leading international efforts to address global climate change.

Federal funding for these activities described in this report differs across these priorities and has shifted over time. Policy instruments and programs depend on funding to differing degrees to be effective; some rely on large amounts of direct federal investment (e.g., in federal R&D) while others primarily require support for administrative expenses.[3]

As congressional and public debate continues with regard to whether and how to address climate change, the priorities for federal funding are likely to evolve further. Members of Congress have expressed a range of views about funding for climate change-related activities. Some question the relative priorities among initiatives or whether the risks of climate change merit the magnitude of federal expenditures and of federal policies on the economy in exchange for benefits that would mostly accrue to future generations, people in other countries, and stability of Earth systems. Other Members point to scientific and economic research to underpin their support for increasing funding to address climate change. Congressional debate on climate change funding takes place in the broader context of stark choices among competing fiscal demands.

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[1] Regulatory actions have included some explicitly required by legislation, such as the Greenhouse Gas (GHG) Reporting Program under the Environmental Protection Agency (EPA). Others that have proceeded under the authority of the Clean Air Act and other existing laws include standards on tailpipe emissions of GHG from vehicles. For more information, see CRS Report R41212, *EPA Regulation of Greenhouse Gases: Congressional Responses and Options*, by James E. McCarthy.

[2] White House, "The President's Climate Action Plan," June 2013, http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf. For more discussion, see CRS Report R43120, *President Obama's Climate Action Plan*, coordinated by Jane A. Leggett.

[3] For example, a program that is the primary financier of a major new technology (e.g., carbon capture and sequestration) generally would require more funds to achieve its intended effects than a program that analyzes, promulgates, and enforces a regulation (depending on the scope and form of the regulation).

Federal Funding for Climate Change

The Office of Management and Budget (OMB) and federal agencies have identified approximately $77 billion of budget authority available to federal agencies from Fiscal Years 2008 through 2013 for climate change activities. The large majority—more than 75%—funded technology development and deployment, mostly through the Department of Energy (DOE). More than one-third of the identified funding during this period was appropriated in the American Recovery and Reinvestment Act of 2009 (P.L. 111-5), enacted February 17, 2009.

This CRS report presents information available on federal budget authority in FY2008 through FY2013, and the President's FY2014 request, for climate change activities of federal departments and agencies. The amounts are reported by OMB, and occasionally by individual departments and agencies where noted. CRS relies on OMB and agency sources of data since most climate-related funding is appropriated at the subaccount level and therefore is not directly identifiable in legislation and committee reports. OMB has produced a "budget cross-cut" for climate change activities when it has been required by language in appropriations bills.[4] Individual agencies often report funding for specific programs, but that information may not be comprehensive or comparable to information on funding for climate change activities in other programs or agencies. Further, when agencies cooperate on programs, double-counting of funding could occur if one were simply to add up what the agencies each report.[5] Some of the OMB and agency sources may report inconsistent or incomplete data.[6] It is CRS's judgment that the amounts in the following tables likely underestimate total federal funding relating to climate change for the period, perhaps on the order of tens of millions of dollars (i.e., not billions). Information is not available for all programs for all years, as explained below.

Climate Change Initiatives

Tables in this report detail funding by agency in terms of budget authority.[7] Funding information is provided for several of the major federal initiatives which address climate change, including the following:

- the Global Change Research Program;

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[4] OMB's most recent report (Office of Management and Budget. *Federal Climate Change Expenditures Report to Congress.* Washington, D.C: Executive Office of the President, August 2013) was released August 28, 2013 in response to Title IV, Division E, Section 425 of the Consolidated Appropriations Act of 2012 (P.L. 112-74), and continued under Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6).

[5] OMB's compilation largely eliminates issues with double-counting.

[6] For more detailed discussion of reporting challenges and examples, see archived CRS Report RL33817, *Climate Change: Federal Program Funding and Tax Incentives*, by Jane A. Leggett, as well as GAO. *Climate Change: Improvements Needed to Clarify National Priorities and Better Align Them with Federal Funding Decisions.* Washington DC, May 20, 2011. http://www.gao.gov/products/GAO-11-317.

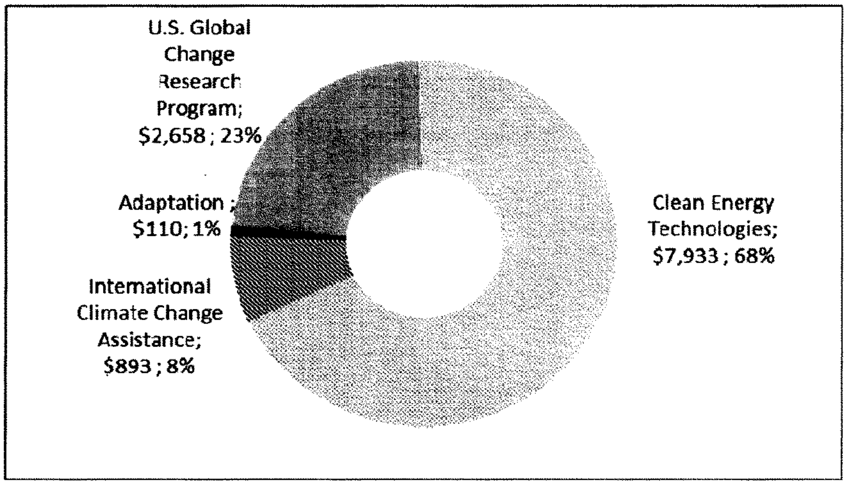
[7] According to OMB, in *Budget System and Concepts* (2008), "budget authority" is "the authority provided by law to incur financial obligations that will result in outlays," or spending. It should not be confused with actual expenditures of funds. See http://www.whitehouse.gov/omb/budget/fy2008/pdf/concepts.pdf. Budget authority identified in this memorandum for a given year is "new budget authority"—which this report uses interchangeably with "funding." New budget authority differs from total budgetary resources, or the total budget authority available for a specific purpose in a given year. (In some contexts, the term budget authority may be used to include new BA plus residual BA left unobligated, or unspent, from previous years.)

- Clean Energy Technologies, largely corresponding to the former Climate Change Technology Program;
- International Assistance, sometimes called the Global Climate Change Initiative; and
- Climate Adaptation, Preparedness, and Resilience.

The President's request for FY2014 contains $11.6 billion for federal expenditures on programs. In the request, 23% would be for science (the U.S. Global Change Research Program or USGCRP), 68% for "clean energy" technology development and deployment, 8% for international assistance, and 1% for adapting to climate change. The Office of Management and Budget (OMB) also reports energy tax provisions that may reduce greenhouse gas (GHG) emissions would reduce tax revenues by $9.8 billion.

Figure 1. The President's Request for Climate Change-Related Budget Authority for FY2014

(in millions of nominal 2013 dollars and percent of the request; excludes tax provisions)



Source: CRS graphic from data in Office of Management and Budget. *Federal Climate Change Expenditures Report to Congress*. Washington, D.C: Executive Office of the President, August 2013.

The Office of Management and Budget (OMB) also reports estimates of Energy Tax Provisions and Energy Grants in Lieu of Tax Provisions that may stimulate deployment of low GHG-emitting technologies. These fiscal incentives serve as exemptions to the baseline tax structure, and usually result in a reduction in the amount of tax owed. A review of these provisions is beyond the scope of this CRS report, though the OMB estimates are provided in **Table 4**.[8]

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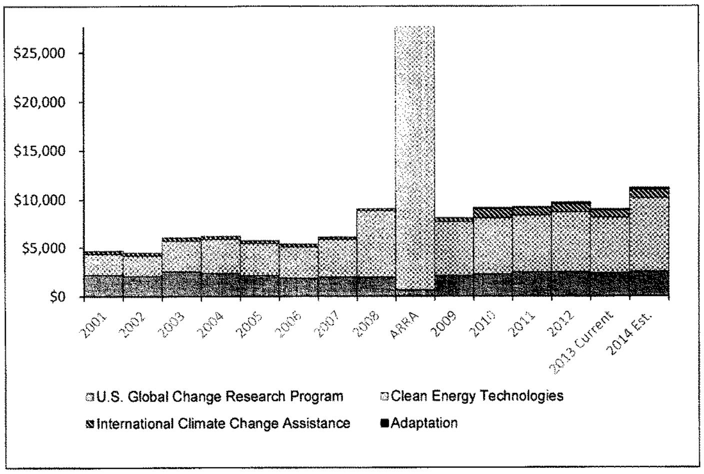
[8] For more information, see U.S. Office of Management and Budget, *Federal Climate Change Expenditures Report to Congress*, June 2010, at http://www.whitehouse.gov/sites/default/files/omb/assets/legislative_reports/FY2011_Climate_Change.pdf.

Minor inconsistencies sometimes exist in alternative reports on funding, perhaps due to rescissions or reprogramming, or because a program may be cast as climate change-related in some contexts but not in others. The reported initiatives are cross-agency "roll-ups" of programs and funding in the agencies, and information on some programs is available only to the degree that the agency has reported funding to OMB or Congress. Some activities, particularly those that consider or address potential impacts of climate change on federal programs or assets, likely existed prior to their being identified as climate change-related, so that funding may have occurred prior or in addition to activities listed in these tables. Other caveats about comparing or examining possible trends in funding are described in more detail in CRS Report RL33817, *Climate Change: Federal Program Funding and Tax Incentives*, by Jane A. Leggett.

This CRS report also provides a series of reported enacted budget authority and tax provisions for climate change programs since FY2001, in **Table 4**. One may presume that past numbers are increasingly inconsistent with present accounting the farther back in time, for reasons explained above. Nonetheless, the general magnitude of overall spending and the shifts in categories of spending may be useful to some. **Figure 2** shows those estimates of historical budget authority since FY2001 to the FY2014 request, adjusted for inflation (i.e., in constant 2012 dollars).

Figure 2. Federal Budget Authority for Climate Change Programs, FY2001 to the FY2014 Request, by Major Category of Program

(in millions of constant 2012 dollars)



Source: CRS figure using the White House Office of Management and Budget. *Federal Climate Change Expenditures Report to Congress*. Washington, D.C: Executive Office of the President, August 2013, as well as past OMB reports released in 2002, 2003, 2004, 2005, 2006, 2008, and 2010.

Notes: To inflate historical figures in 2012 dollars, CRS used OMB, *The Budget for Fiscal Year 2014, Historical Tables*, Table 10.1- Gross Domestic Product and Deflators Used in the Historical Tables: 1940-2018. CRS used the index for non-defense expenditures and adjusted the index so FY2012=1.0.

Names for groupings of programs aimed generally at the same goals have shifted through successive Administrations. The U.S. Global Change Research Program (USGCRP) was supplemented by the early 2000s with the Climate Change Science Program (CCSP), which is now folded into the USGCRP. Similarly, energy development and deployment programs, called the Climate Technologies Initiative in the late 1990s and the Climate Change Technologies Program (CCTP) through the 2000s, is largely consistent with the Clean Energy Technologies category reported most recently by OMB and illustrated in this figure. This time series presents the totals reported without attempting to adjust for minor changes in scope and emphasis across the initiatives.

Through most of the 1990s, most federal funding identified to address climate change was directed at improving the science, under the U.S. GCRP.[9] As **Figure 2** shows, by FY2001, investment in climate-related energy technology research, development, and deployment (Clean Energy Technologies) surpassed science (the U.S. GCRP) as the largest component of federal activities and has continued to increase its share since then; the share in FY2013 enacted budget authority shrunk slightly from FY2012, however. The one-time investment in climate-related technologies contained in the American Recovery and Reinvestment Act of 2009 (P.L. 111-5) was notably large and still constitutes more than one-fifth of all identified federal expenditures since FY2001 (including the FY2014 request). Adaptation to climate change has been added to the identified federal expenditures since FY2010, but remains too small to be seen as a share on the time series figure.

The Global Change Research Program (USGCRP)

The U.S. Global Change Research Program (USGCRP) was mandated by Congress in the Global Change Research Act of 1990 (P.L. 101-606). The USGCRP is intended to improve understanding of climate science, including the cumulative effects of human activities and natural processes on the environment; develop science-based resources to support policymaking and resource management; and communicate findings broadly among scientific and stakeholder communities. Thirteen departments and agencies participate in the USGCRP.[10] The White House Office of Science and Technology Policy (OSTP) and the Office of Management and Budget (OMB) work with the USGCRP to establish research priorities and funding plans to help ensure that the program is aligned with the Administration's priorities and reflects agency planning.

Table 1 below presents estimates for direct federal funding for the USGCRP from FY2008 through the FY2014 request. During the George W. Bush Administration, a second set of scientific research programs was identified and named the Climate Change Science Program. The CCSP is now merged into the USGCRP in the cross-cut budget.

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[9] See GAO. Climate Change: Federal Reports on Climate Change Funding Should Be Clearer and More Complete. Washington DC, August 25, 2005. http://www.gao.gov/products/GAO-05-461.

[10] The Agency for International Development does not receive direct budget authority, but receives funding from other USGCRP agencies to cooperate in a few projects in low-income countries, for example, to support development of drought early warning systems. The Department of Defense also performs research related to global climate change, but those amounts are not included in the budget request for the USGCRP.

Table 1. Budget Authority for the Global Change Research Program (USGCRP)

(in millions of nominal dollars)

Agency	2008 Actual	ARRA Enacted	2009 Enacted	2010 Enacted	2011 Enacted	2012 Enacted	2013 Current[a]	2014 Request
Department of Agriculture	$63	$0	$0	$121	$116	$116	$106	$126
Department of Commerce	272	218	377	363	338	319	302	371
Department of Energy	128	65	168	171	183	211	209	220
Department of Health and Human Services	4	0	5	4	4	14	14	15
Department of the Interior	34	0	45	63	64	59	55	72
Department of State	0	0	0	14	3	3	3	3
U.S. Agency for International Development	0	0	0	28	25	11	11	14
Department of Transportation	1	0	2	3	1	1	1	1
Department of the Treasury	0	0	0	0	0	0	0	0
Environmental Protection Agency	17	0	18	21	20	18	17	20
National Aeronautics and Space Administration	1,084	237	1,086	1,123	1,431	1,427	1,435	1,499
National Science Foundation	207	121	269	320	321	333	316	326
Smithsonian Institution	6	0	6	7	7	8	8	8
Totals	**$1,816**	**$641**	**$2,023**	**$2,238**	**$2,513**	**$2,506**	**$2,463**	**$2,658**

Source: Office of Management and Budget. *Federal Climate Change Expenditures Report to Congress.* Washington, DC: Executive Office of the President, June 10, 2010, and August 28 2013; Office of Management and Budget. *Analytical Perspectives—Budget of the U.S. Government.* Washington DC: Executive Office of the President, 2010, 2011, 2012, and 2013. USGCRP website, http://www.globalchange.gov/about/budget-documents. For FY2012 and FY2014, http://www.whitehouse.gov/sites/default/files/microsites/ostp/2014_R&Dbudget_climate.pdf.

Notes: N.A., or "not available," means that CRS could not identify appropriate figures.

Regular year funding for FY2009 and supplemental appropriations in the American Recovery and Reinvestment Act of 2009 (ARRA) (P.L. 111-5) are identified separately in this table.

a. FY2013 Current Budget Authority, according to OMB, as of June 21, 2013. It reflects funds available calculated as the amount appropriated (FY2013 Enacted Budget Authority, data not shown), minus reductions triggered by the Budget Control Act of 2011 (P.L. 112-25) sequestration order issued March 1, 2013

Clean Energy Technologies

The Clean Energy Technologies (CET) efforts are intended to research, develop, and deploy technologies that would reduce GHG emissions compared to technologies currently commonly used. Besides federal R&D, CET includes a variety of voluntary partnership and grant activities.

Funding provided by the CET initiative is intended to stimulate the development and use of selected energy technologies, including renewable, low-carbon fossil, and nuclear technologies as well as energy efficient technologies, products, and process improvements. Consequently, the large majority of CET budget authority has been in the Department of Energy.

The CET initiative is a recent iteration of the Climate Change Technology Program (CCTP) that was formally established administratively under President George W. Bush, which itself included a number of existing programs. The FY2014 budget request calls for an investment of nearly $7.9 billion in support of CET, a 30% and 37% increase in comparison to the enacted FY2012 and current FY2013 budget authority, respectively. These funds reflect the current Administration's priority for new technologies as a means to facilitate future GHG reductions and meet the President's GHG emissions reduction targets, in the range of 17% below 2005 levels by 2020 and approximately 83% below 2005 levels by 2050. Meeting the 2050 target would likely require radical change from the currently prevalent energy system.

The Department of Energy coordinated the CCTP inter-agency effort through a central office. It is unclear to what degree the current programs are coordinated as an inter-agency strategy, or through what mechanism. However, as is apparent in the budget figures below, most of the activities are within the Department of Energy.

Table 2 presents estimates, to the extent they are available, for direct federal funding for the CCTP from FY2008 through the FY2014 request.

Table 2. Budget Authority for Clean Energy Technologies (Largely the Former Climate Change Technology Program)

(in millions of nominal dollars)

Agency	2008 Actual	ARRA Enacted	2009 Enacted	2010 Enacted	2011 Enacted	2012 Enacted	2013 Current[a]	2014 Request
Department of Agriculture	$205	$271	$100	$453	N.A.	$275	$305	$265
Department of Commerce	8	4	15	18	N.A.	40	40	43
Department of Defense	150	139	261	226	N.A.	481	437	457
Department of Energy	5,745	25,223	4,543	4,399	5,503	4,388	4,144	6,212
Department of Transportation	19	100	43	125	N.A.	91	56	52
Environmental Protection Agency	107	0	111	133	113	117	111	115
National Aeronautics and Space Administration	139	31	119	124	N.A.	296	276	321
National Science Foundation	21	2	24	26	30	341	346	372
Nuclear Regulatory Commission	N.A.	N.A.	N.A.	N.A.	N.A.	83	57	86
Tennessee Valley Authority	N.A.	N.A.	N.A.	N.A.	N.A.	9	11	10
Totals	**$6,394**	**$25,770**	**$5,216**	**$5,504**	**$5,646**	**$6,121**	**$5,783**	**$7,933**

Source: Climate Change Technology Program, workbook of detailed funding data provided to CRS, 2008; Office of Management and Budget. *Federal Climate Change Expenditures Report to Congress.* Washington, DC: Executive Office of the President, June 10, 2010, and August 28, 2013; DOE CCTI estimates in FY2010-2012 enacted also from http://www.cfo.doe.gov/budget/12budget/Content/Volume2.pdf (p. 200); and (p. 135); NSF enacted for CCTP also from http://nsf.gov/about/budget/fy2012/pdf/fy2012_rollup.pdf, p. 12, and http://www.nsf.gov/about/budget/fy2013/pdf/02-Summary_Tables_fy2013.pdf.

Notes: N.A., or "not available," means that CRS could not identify appropriate figures.

Regular year funding for FY2009 and supplemental appropriations in the American Recovery and Reinvestment Act of 2009 (ARRA) (P.L. 111-5) are identified separately in this table.

a. FY2013 Current Budget Authority, according to OMB, as of June 21, 2013. It reflects funds available calculated as the amount appropriated (FY2013 Enacted Budget Authority, data not shown), minus reductions triggered by the Budget Control Act of 2011 (P.L. 112-25) sequestration order issued March 1, 2013.

International Assistance

The United States supports international financial assistance for global climate change initiatives in developing countries. Under the Obama Administration, this assistance has been articulated primarily as the Global Climate Change Initiative (GCCI), a platform within the President's 2010 Policy Directive on Global Development. The GCCI aims to integrate climate change considerations into U.S. foreign assistance through a range of bilateral, multilateral, and private sector mechanisms to promote sustainable and climate-resilient societies, foster low-carbon growth, and reduce emissions from deforestation and land degradation. The GCCI is implemented primarily through programs at three "core" agencies: the Department of State, the Department of the Treasury, and the U.S. Agency for International Development (USAID). Most GCCI activities at USAID are implemented through the agency's bilateral development assistance programs. Many of the GCCI activities at the Department of State and the Department of the Treasury are implemented through international organizations, including the United Nations Framework Convention on Climate Change's Least Developed Country Fund and Special Climate Change Fund, as well as multilateral financial institutions such as the Global Environment Facility, the Clean Technology Fund, and the Strategic Climate Fund.

Table 3 presents estimates for federal budget authority for the GCCI from FY2008 through the FY2014 request.[11]

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[11] For more information, see CRS Report R41845, *The Global Climate Change Initiative (GCCI): Budget Authority and Request, FY2010-FY2014*, by Richard K. Lattanzio.

Table 3. Budget Authority for the International Climate Change Assistance (Also Referred to as the Global Climate Change Initiative, or GCCI)

(in millions of nominal dollars)

Agency	2008 Actual	ARRA Enacted	2009 Enacted	2010 Enacted	2011 Enacted	2012 Enacted	2013 Current[a]	2014 Request
Department of Agriculture	$0	$0	$4	$5	N.A.	$3	$3	$1
Department of Commerce	0	0	11	11	N.A.	N.A.	N.A.	N.A.
Department of Energy	0	0	0	13	N.A.	13	13	13
Department of State	41	0	55	202	125	133	126	133
US Agency for International Development	115	0	222	306	398	348	335	349
Department of the Treasury	46	0	46	438	296	377	296	356
Environmental Protection Agency	0	0	20	21	N.A.	18	16	19
Millennium Challenge Corporation	0	0	0	2	N.A.	41	0	0
National Aeronautics and Space Administration	0	0	2	2	N.A.	3	3	3
National Science Foundation	0	0	3	6	N.A.	6	6	3
US Trade and Development Agency	0	0	10	17	N.A.	16	0	18
Totals	**$202**	**$0**	**$373**	**$1,023**	**$819**	**$958**	**$797**	**$893**

Source: Office of Management and Budget. *Federal Climate Change Expenditures Report to Congress.* Washington, DC: Executive Office of the President, June 10, 2010, and August 28, 2013; CRS Report R41845, *The Global Climate Change Initiative (GCCI): Budget Authority and Request, FY2010-FY2014*, by Richard K. Lattanzio.

Notes: N.A., or "not available," means that CRS could not identify appropriate figures.

Regular year funding for FY2009 and supplemental appropriations in the American Recovery and Reinvestment Act of 2009 (ARRA) (P.L. 111-5) are identified separately in this table.

OMB began to provide a budget cross-cut for the GCCI for FY2011, identifying specific funding amounts for the principal international agencies involved and noting that other agencies contribute. OMB did not identify specific enacted budget authorities for those other agencies, and doing so would likely double-count at least some of the funds represented in other tables. Where CRS understands that no funds were available, a zero is used; in those cases where some funds may be used in conjunction with the GCCI, CRS uses N.A. in this table.

a. FY2013 Current Budget Authority, according to OMB, as of June 21, 2013. It reflects funds available calculated as the amount appropriated (FY2013 Enacted Budget Authority, data not shown), minus reductions triggered by the Budget Control Act of 2011 (P.L. 112-25) sequestration order issued March 1, 2013.

Climate Adaptation, Preparedness, and Resilience

Funding does not appear to be reported by most agencies in support of their plans to adapt to climate change, or "Adaptation Plans," as stipulated under Executive Order 13514 and reported since 2012 in agencies' Strategic Sustainability Performance Plans (SSPPs). Many agencies are in early stages of planning or implementation, and the related funding would in almost all cases be in the details of appropriations accounts, and therefore not readily available.

One exception is the Department of the Interior (DOI). The Secretary of Interior issued Secretarial Order 3289 in 2009 (amended in 2010), "addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources." DOI has identified vulnerabilities to its missions and assets, as well as to tribes and their resources, and has developed plans and associated budgets to address those vulnerabilities. According to OMB, enacted budget authority for this purpose increased from $88 million in FY2012 to $90 million in FY2013 (after sequestration). The request for FY2014 was $110 million. These amounts do not include resources in the U.S. Geological Survey, as their efforts to provide related science to support the bureaus and other agencies are reported in the USGCRP.

Principal Observations and Legislative Issues

Over the past two decades, federal funding for climate change-related activities has expanded from scientific research, almost exclusively, to a wide variety of programs to (1) develop and disseminate technologies; (2) build an informational and analytical foundation for future policy actions; (3) plan for adaptation to actual or expected climate change; (4) assist private sector decision-makers and lower-income countries; and (5) address additional needs. Federal strategy on climate change largely reflects the aggregation of a variety of existing programs, presidential initiatives, and congressionally directed activities. Presidential initiatives have been built largely from existing programs, and agencies have contributed to shared program goals using existing resources and expertise. Priorities tend to be based on departmental missions and the degree of support for the input activities. As the debate continues over appropriate strategies to address climate change, the needs and priorities for funding are likely to evolve further.

Federal budget for climate change-related programs is primarily aimed at investment and tax provisions aimed at stimulating energy technologies that may reduce GHG emissions. The Clean Energy Technologies category represents 68% of the President's request for FY2014. Over the period since FY2001, including the FY2014 request, these technology programs constitute more than 70% of all funding for identified climate change-related programs (excluding tax provisions). By itself, the one-time injection of resources in the American Recovery and Reinvestment Act of 2009 (P.L. 111-5)—almost entirely for energy technology development—is nearly one-quarter the cumulative spending from FY2001 through FY2013.

Since FY2001, funding for climate change science has remained roughly constant, varying up or down by as much as 15% in real dollars (i.e., adjusted for inflation). Funding for science was near its real-dollar low in FY2008, and would almost reach a high if the FY2014 request were enacted. (The peak was $2,577 million in FY2003 in 2012 constant dollars.)

International assistance, to facilitate capacity-building and efforts by selected, low-income countries to mitigate their GHG emissions and adapt to expected climate change, has nearly tripled from FY2001 to the current FY2013 budget authority. The FY2014 request proposed an increase of the current FY2013 amount by 9.5%, to $856 million. This is 8% of the President's request.

Adaptation to climate change has grown in attention across the federal agencies, as well as across segments of the public and private sector. Although activities in the federal agencies have expanded, especially since 2009, little of this activity is reported in OMB's budget cross-cut. This omission probably reflects the relatively low level of effort in most agencies, and that efforts are typically add-ins to wider programs rather than stand-alone activities. For example, grants for coastal zone planning may incorporate effects of potential sea level rise and storm surges as one consideration among many in those plans. Only the Department of the Interior, which has a department-wide effort to identify and address vulnerabilities to the assets it manages, explicitly reports adaptation funds. This is less than 1% of the FY2013 funding across agencies.

Interpreting how funding relates to levels of effort to address climate change is challenged by several reporting issues. Identifying actual funding for climate change activities is clouded by several ongoing issues, including the following:

- the levels of aggregation of the budget request;
- changes in scope of what is reported;
- changes in accounting methods used over time;
- inconsistencies across agencies in defining and interpreting methods for reporting activities;
- lack of description by agencies for subaccount level climate change-related activities in their budget documentation; and
- omissions of reporting of some arguably climate-related activities in the overall program.

In light of these issues, the Government Accountability Office (GAO) investigated the Administration's reporting practices in 2005, 2006, and 2011.[12] GAO recommended that the Administration provide greater clarity and consistency of reporting on federal funding for climate change activities. While some improvements were made following the 2006 GAO report, many issues persist, confounding analysis of climate change funding. The 2011 GAO report concluded that there were two key factors that "complicate efforts to align funding with priorities": (1) "... federal officials do not have a shared understanding of strategic priorities" and (2) "... since mechanisms for aligning funding with priorities are nonbinding, they are limited when in conflict with agencies' own priorities."[13] In addition, congressional priorities may differ from the President's goals and requests, further complicating alignment of goals and priorities.

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[12] GAO, *Improvements Needed to Clarify National Priorities and Better Align Them with Federal Funding Decisions* GAO-11-317, May 20, 2011; GAO, *Climate Change: Greater Clarity and Consistency Are Needed in Reporting Federal Climate Change Funding*, GAO-06-1122T, Washington DC, September 21, 2006; GAO. *Climate Change: Federal Reports on Climate Change Funding Should Be Clearer and More Complete*. Washington DC, August 25, 2005.

[13] GAO. *Climate Change: Improvements Needed to Clarify National Priorities and Better Align Them with Federal Funding Decisions*. Washington DC, May 20, 2011. http://www.gao.gov/products/GAO-11-317. Highlights.

The funding data described in this report derive primarily from OMB's series of *Reports to Congress on Federal Climate Change Expenditures* published through the requirements in various appropriation laws passed from 2002 through 2008, 2010, and 2012. In response to language included in FY2012 appropriations, OMB released its latest report on August 28, 2013. It appears that OMB produces these budget cross-cuts only when required by legislation. If the 113th Congress finds data on climate change funding and programs useful for oversight and other legislative purposes, it may consider renewing requirements for reporting of climate change-related activities, including directions that would continue to improve clarity and consistency compared to previous reports.

Viewing Efforts Across Federal Agencies and Programs Through a Cross-Cut Budget

Compilation and strategic management of resource allocation and use across agencies for a particular policy, called a "cross-cut budget," is occasionally used in federal budgeting and appropriations.[14] On the one hand, cross-cut budgeting may be a useful exercise where a policy area or one or more policy goals engage a variety of departments and agencies. With a cross-cut budget, Congress, agencies, and non-federal stakeholders may seek to better understand and align resources and implementation across agencies and appropriations subcommittees. On the other hand, the development of cross-cut budgets also may add workload for related agencies and the Office of Management and Budget. For reasons stated in this report by GAO, and others, budget cross-cuts and long time-series may contain inconsistencies—due to changing terminology, concepts, and priorities—that track ongoing developments but also may limit the reliability and utility of underlying data, to some extent.

Some Members of Congress have expressed interest in how federal funding may reflect and enable the Obama Administration's overall strategy, and priorities within it, to address climate change. Beyond the amounts of budget authority in this report, further legislative considerations regarding the federal funding of climate change activities may include the following:

- the sufficiency and alignment of federal resources to support a strategy to achieve long-term climate change policy goals;
- the demands of climate change adaptation programming for federal agencies, their programs, and resources;
- whether additional and predictable foreign aid resources may be provided to support actions by low-income countries to mitigate greenhouse gases or adapt to climate change;
- possible legislative proposals to restructure or improve collaboration among agencies regarding climate change activities; and
- the incorporation of recommendations from evaluations (whether internal or external) to improve climate change programs.

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[14] For another federal cross-cut budget, see discussion in CRS Report RL34329, *Crosscut Budgets in Ecosystem Restoration Initiatives: Examples and Issues for Congress*, by Pervaze A. Sheikh and Clinton T. Brass.

Table 4. Federal Climate Change Programs: FY2001-FY2013 Enacted, and the President's FY2014 Request

(in millions of nominal dollars, except where noted)

Major Climate Change Program Areas	Budget Authority (Fiscal Years, Enacted Except FY2013 and FY2014)														
	2001	2002	2003	2004	2005	2006	2007	2008	ARRA	2009	2010	2011	2012	2013 Current[a]	2014 Request
U.S. Global Change Research Program (including the former Climate Change Science Program)	$1,728	$1,667	$2,078	$1,996	$1,864	$1,691	$1,825	$1,864	$641	$2,023	$2,195	$2,448	$2,506	$2,463	$2,658
Clean Energy Technologies (formerly Climate Change Technology Program)	$1,675	$1,637	$2,533	$2,870	$2,808	$2,789	$3,485	$6,394	$25,499	$5,216	$5,504	$5,646	$6,121	$5,783	$7,933
International Climate Change Assistance	$218	$224	$270	$252	$234	$249	$188	$202	$0	$323	$939	$819	$958	$797	$893
Adaptation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$69	$35[a]	$88	$90	$110
All Areas	**$3,621**	**$3,528**	**$4,881**	**$5,118**	**$4,906**	**$4,729**	**$5,498**	**$8,460**	**$26,140**	**$7,562**	**$8,707**	**$8,948**	**$9,673**	**$9,133**	**$11,594**
All Areas in Constant 2012 Dollars	*$4,650*	*$4,471*	*$6,053*	*$6,189*	*$5,745*	*$5,361*	*$6,076*	*$9,027*	*$27,739*	*$8,025*	*$9,112*	*$9,166*	*$9,673*	*$8,955*	*$11,112*

Major Climate Change Program Areas	Budget Authority (Fiscal Years, Enacted Except FY2013 and FY2014)														
	2001	2002	2003	2004	2005	2006	2007	2008	ARRA	2009	2010	2011	2012	2013 Current[a]	2014 Request
	Estimated Revenue Loss Effects of Energy Tax Provisions														
Energy Tax Provisions That May Reduce Greenhouse Gases	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**ARRA**	**2009**	**2010**	**2011**	**2012**	**2013 Est.**	**2014 Est.**
	$0	$0	$580	$500	$369	$1,160	$1,520	$1,520	$0	$1,440	$4,140	N.A.	$10,132	$13,079	$9,839
Tax Expenditures in Constant 2012 dollars	*$0*	*$0*	*$719*	*$605*	*$432*	*$1,315*	*$1,680*	*$1,622*	*$0*	*$1,528*	*$4,332*	*$0*	*$10,132*	*$12,824*	*$9,430*
Total Budgetary Impact[b]	**$3,621**	**$3,522**	**$5,461**	**$5,618**	**$5,275**	**$5,889**	**$7,018**	**$9,980**	**$26,140**	**$9,002**	**$12,277**	**N.A.**	**$19,805**	**$22,212**	**$21,433**
Total Budgetary Impact in Constant 2007 Dollars	*$4,650*	*$4,471*	*$6,773*	*$6,793*	*$6,178*	*$6,676*	*$7,756*	*$10,648*	*$27,739*	*$9,553*	*$13,444*	*$9,166*	*$19,805*	*$21,779*	*$20,542*

Source: Prepared by CRS based on data reported by OMB, including in *Federal Climate Change Expenditures Report to Congress FY2014*, August 2013; *Federal Climate Change Expenditures Report to Congress, FY2008*, May 2007, Table 8, p. 27; *Federal Climate Change Expenditures Report to Congress, August 2003*, Table 1; and *Federal Climate Change Expenditures Report to Congress, July 2002*, Table 1.

Notes: OMB adjusted the science and technology amounts for FY2003, FY2004, and FY2005 to reflect more recent accounting within these program areas. Remaining inconsistencies are likely across years due to changes in the scopes of what is considered for "climate change" and methods of allocating certain costs to programs.

To convert from nominal to 2012 dollars, CRS used OMB, *The Budget for Fiscal Year 2014, Historical Tables*, Table 10.1- Gross Domestic Product and Deflators Used in the Historical Tables: 1940-2018. CRS used deflators for non-defense expenditures and adjusted index so FY2012=1.0.

The total impact to the federal budget in each year as reported by OMB may differ somewhat from the sum of budget authority for each program area and the estimates of tax expenditures, due to exclusion by OMB of dollar amounts for certain activities to avoid double-counting.

a. FY2013 Current Budget Authority, according to OMB, as of June 21, 2013. It reflects funds available calculated as the amount appropriated (FY2013 Enacted Budget Authority, data not shown), minus reductions triggered by the Budget Control Act of 2011 (P.L. 112-25) sequestration order issued March 1, 2013.

b. Because the estimate for the adaptation efforts in this year is incomplete, this figure is likely an underestimate of the actual amount.

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HARVARD Kennedy School
JOHN F. KENNEDY SCHOOL OF GOVERNMENT

Advancing Carbon Sequestration Research in an Uncertain Legal and Regulatory Environment

A Study of Phase II of the DOE Regional Carbon Sequestration Partnerships Program

CRAIG A. HART

Discussion Paper 2009-01
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Advancing Carbon Sequestration Research in an Uncertain Legal and Regulatory Environment: A Study of Phase II of the DOE Regional Carbon Sequestration Partnerships Program

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Discussion Paper

January 7, 2009

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Abstract

This study examines the legal and regulatory barriers encountered in carbon capture and sequestration (CCS) research, development and demonstration (RD&D) projects under the U.S. Department of Energy's (DOE) Regional Carbon Sequestration Partnerships Program. The study conducts a survey of 19 of the 25 Phase II geologic sequestration projects and examines two of these projects as case studies. The barriers encountered involved liability, consents, and permitting. They created challenges for small-scale RD&D projects that involve little risk, are in the public interest, and are essential to advancing our understanding of CCS if it is to contribute to mitigating climate change on a meaningful scale. To overcome these barriers, this study recommends the federal government adopt policies that provide a legal framework that supports CCS research, specifically a shield from property-related and long-term liabilities associated with sequestration for research organizations and other organizations supporting research; and government indemnity to protect and make whole property rights holders, parties granting consent to projects, and third parties who may be affected by CCS research. The study also recommends that the U.S. Environmental Protection Agency (EPA) consider simplified approval procedures under the Safe Drinking Water Act for small-scale research injections.

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The views expressed within this paper are the author's and do not necessarily reflect those of the Energy Technology Innovation Policy research group, the Belfer Center for Science and International Affairs, or Harvard University. This paper is available at www.belfercenter.org/energy.

Energy Technology Innovation Policy

The overarching objective of the Energy Technology Innovation Policy (ETIP) research group is to determine and then seek to promote adoption of effective strategies for developing and deploying cleaner and more efficient energy technologies, primarily in three of the biggest energy-consuming nations in the world: the United States, China, and India. These three countries have enormous influence on local, regional, and global environmental conditions through their energy production and consumption.

ETIP researchers seek to identify and promote strategies that these countries can pursue, separately and collaboratively, for accelerating the development and deployment of advanced energy options that can reduce conventional air pollution, minimize future greenhouse-gas emissions, reduce dependence on oil, facilitate poverty alleviation, and promote economic development. ETIP's focus on three crucial countries rather than only one not only multiplies directly our leverage on the world scale and facilitates the pursuit of cooperative efforts, but also allows for the development of new insights from comparisons and contrasts among conditions and strategies in the three cases.

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Introduction

Geologic carbon capture and sequestration (CCS) involves the capture of carbon dioxide (CO_2), typically at a power plant or industrial facility, transport, and ultimate injection of the CO_2 into subsurface geologic formations, principally saline formations, depleted oil and gas reservoirs, and deep uneconomically mineable coal seams. CCS can potentially make a significant contribution to mitigating climate change by permanently storing CO_2 produced by coal-fired power plants and other sources underground as opposed to emitting it to the atmosphere.

A growing number of commercial enhanced oil recovery (EOR), enhanced gas recovery (EGR) and permanent sequestration projects have already significantly advanced CCS knowledge. Projects are being undertaken in Europe, Africa, Australia, Japan, China and India.[1] StatoilHydro's Sleipner Field in the Norwegian Sea and its Sn0hvit Field in the Barents Sea, the Weyburn CO_2-EOR Enhanced Oil Recovery project in the Weyburn Oil field in Canada, the BP/StatoilHydro In Salah Project in Algeria, and the Vattenfall Schwarze Pumpe power station in Germany are already operating.

Further research and development will be necessary to deploy CCS at the scale necessary to contribute to mitigating climate change. The U.S. Department of Energy (DOE) Office of Fossil Energy sponsors the Regional Carbon Sequestration Partnerships Program, a nationwide multi-phase program to assess the performance, costs, and risks of CCS over a broad range of geologic conditions in order to assess its feasibility at commercial scale. The DOE's partnerships program is a broad and appropriately ambitious research program for assessing and developing CCS as a potential method to address climate change. The International Energy Agency (IEA) recently convened an expert panel that reviewed the program and concluded that it will "significantly advance and accelerate" CCS, and that the size and scope of the program is unmatched throughout the world.[2]

This study surveyed 19 of the 25 Phase II geologic sequestration pilot projects of the DOE Regional Carbon Sequestration Partnerships Program for which data are available, and examined in detail two of these projects as case studies.[3] Appendix A lists the Phase II geologic sequestration projects surveyed in this study.

The survey and case studies reveal that issues surrounding long-term liability have created significant barriers in a number of small-scale research, development and demonstration (RD&D) projects that are acknowledged to involve little or no risk. Without a clear legal framework governing liability or the ability of research partnerships to indemnify third parties for potential liability, substantial staff time and resources of research organizations were required to address these issues, leading to delays and in one case cancellation of a project. The study also found that permitting requirements under the Safe Drinking Water Act[4] for small-scale research projects have required significant research organization staff time.

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[1] IEA Greenhouse Gas R&D Programme (2008). CO_2 Capture and Storage Projects Database, *available at* http://www.co2captureandstorage.info/search.php (accessed March 26, 2008).

[2] IEA Greenhouse Gas R&D Programme (2008). Expert Review of Regional Carbon Sequestration Partnerships Phase III.

[3] Phase II comprises 25 geologic sequestration projects and 11 terrestrial sequestration projects. Of the 25 projects involving geologic carbon sequestration, data were available for 19 projects. The study did not look at the terrestrial sequestration projects.

The study uses the term "significant" or "substantial" interchangeably, to indicate those barriers that have or have the potential to consume substantial financial or personnel resources of research organizations, to the point that they can delay or block progress in conducting research. Clearing barriers to CCS research is important because this research is in the public interest and essential if we are to assess and develop CCS technology as a potential solution to climate change. The recommendations in this study are not intended to subordinate environmental protections to basic research; instead, they are intended to accommodate CCS research within existing legal and regulatory schemes that are not presently designed to accommodate such research.

To overcome legal and regulatory barriers to CCS research, this study recommends that the federal government provide a shield from property-related and long-term liabilities associated with sequestration for research organizations and other organizations supporting research; and government indemnity to protect and make whole property rights holders, parties granting their consent to projects, and third parties who may be affected by CCS research. The indemnification provision would be limited in scope, amount, and duration. The U.S. Environmental Protection Agency (EPA) should also consider a simplified approval process under the Safe Drinking Water Act (SDWA) for qualifying CCS research.

This study first explains the role that RD&D projects will play in supporting the development of commercial-scale CCS projects. It then briefly discusses the current state of U.S. law and regulation governing CCS as background to the conditions under which CCS research is conducted, and identifies areas of uncertainty due to an incomplete legal framework. Next, it introduces the DOE Regional Carbon Sequestration Partnerships Program, summarizes the results of the survey of 19 of the Phase II pilot projects and examines two case studies. Finally, it analyzes the legal barriers encountered in these projects, and, on the basis of this analysis, proposes policy recommendations for advancing CCS RD&D efforts in the United States.

Need for Continuing Research to Support Commercial-Scale CCS

Research will continue to be important to assessing and developing CCS after the Phase II projects have been completed.

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[4] 42 U.S.C. § 300f et seq. (2008).

Early pilot projects have shown that the most complete understanding of the site-specific behavior of CO_2 has come from monitoring the movement of CO_2 itself.[5] Research experiments have provided important information for studying CO_2 migration in various types of formations. Well-designed test injections could be employed to collect data on response measures to leakage or other contingencies. In a commercial setting, research-scale tests could be used during the assessment phase of a project before a larger investment is made in fully characterizing an area.

Members of the research community and practitioners interviewed for this study widely agreed that continued research will be essential to the development of CCS, even after CCS is deployed in several commercial-scale plants. Just as research in the oil and gas area continues and is increasing as that industry seeks to take advantage of new technologies and overcome increasingly challenging conditions as fields mature, research in various aspects of CCS is likely to be indispensable in such areas as exploring potential new sites, and improving tools for monitoring, measurement, verification and remediation.

CCS research also will be essential for stakeholders to assess various risks, including those relating to health and safety, commercial operations, liability for property and natural resources damage, trespass, and leakage of CO_2. These stakeholders include project developers, investors, lenders, service providers, land and rights owners, regulatory agencies, and insurers. A large and robust database containing multiple data points collected from actual projects over a broad range of geologic and other conditions (e.g., subsurface geophysical, depth, pressure, seismic, climatic) is necessary for developing more accurate metrics for engineering and costs, technological risks, risk assessment of geologic formations and specific sites, and development of early detection monitoring and risk mitigation plans in the event of leakage or unexpected events (e.g., sudden pressure change, increase in CO_2 concentration in soil, seismic events, brine intrusion to drinking water reservoirs).[6]

Incomplete U.S. Legal and Regulatory Framework Governing CCS

The United States currently does not have comprehensive federal law or regulations explicitly designed for CCS. Several regulations apply to different aspects of CCS activities. Most importantly, the EPA regulates underground injections of CO_2 pursuant to its authority under the SDWA, which protects the safety of drinking water supplies. Transportation and worker health and safety regulations also apply to industrial operations involving CO_2. The Resource Conservation and Recovery Act (RCRA)[7] and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)[8] also potentially apply to CCS activities. Property and related liability issues fall outside federal regulations governing CCS,[9] and are handled by different state laws, none of which specifically provide for CCS within a coherent legal framework. Appendix B provides a summary of U.S. federal and state laws governing CCS.

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[5] Christine Doughty, Barry M. Freifeld, Robert C. Trautz, "Site Characterization for CO_2 Geologic Storage and Vice Versa: The Frio Brine Pilot, Texas, USA as a Case Study," 54 ENVIRONMENTAL GEOLOGY 1635-1656 (2007).

[6] The DOE's NatCarb initiative, which links geological and emission databases from several regional centers into a single interactive mapping system, could play an important role in ensuring that these data are publicly available.

Without a comprehensive or consistent legal framework at either the federal or state level, CCS faces legal uncertainty in virtually every aspect of activity, including:[10]

- CO_2 capture (e.g., performance requirements under future regulation)
- CO_2 transportation (e.g., pipeline ownership, safety, regulation and access)
- State property law governing reservoirs, pore space, and injected CO_2
- Liability for leakage of CO_2 (regulatory liability for emissions control, and contractual liability for carbon trading)
- Liability for damage to property (induced seismicity, commingled resources)
- Liability for trespass (multiple users of reservoirs, boundary disputes, including transnational and international waters)
- Liability for CCS activities after transfer of ownership of property
- Liability under RCRA, CERCLA and other environmental statutes
- Health, safety and environmental liability (worker safety, groundwater contamination, flora, fauna) under federal and state regulations
- CCS site selection, permitting, operation and closure
- Long-term monitoring, remediation, and financial responsibility for CCS sites
- Treatment and accounting of CCS as a mitigation measure under voluntary and mandatory climate change regimes

DOE Regional Carbon Sequestration Partnerships Program

The DOE launched the Regional Carbon Sequestration Partnerships Program in 2003 to develop the infrastructure and knowledge base needed to commercialize carbon sequestration technologies. The program comprises three phases: (I) characterization of national CO_2 storage potential in deep oil-, gas-, coal-, and saline-bearing formations; (II) twenty-five geologic sequestration RD&D test injection projects to validate that these different geologic formations have the injectivity, containment, and storage effectiveness necessary for long-term sequestration, and eleven terrestrial sequestration projects;[11] and (III) seven commercial-scale geologic sequestration projects to demonstrate the engineering and scientific processes and to validate the long-term safe storage of CO_2 in several major geologic formations capable of storing emissions generated from major point sources, on a cost-effective basis.[12] Appendix A contains a list of the Phase II geologic sequestration projects surveyed in this study.

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[7] 42 U.S.C. §6901 et seq. (2008).

[8] 42 U.S.C. §9601 et seq. (2008).

[9] See In re Core Energy, LLC, UIC Appeal No. 07-02 (E.A.B., December 19, 2007).

[10] See IEA (2007), Legal Aspects of Storing CO_2 Update and Recommendations for Future Work; Kipp Coddington, Robert Mowrey, Geir Vollsaeter, and Kristin Holloway Jones, CCS Issues under the Safe Drinking Water Act, dated May 10, 2008 (on file with the author).

The program is organized as seven regional partnerships, each tasked with conducting all phases within their region. At the time of writing, the program has substantially completed Phase I for most of the United States, has completed or commenced most of the Phase II projects, and is in the early stages of the Phase III projects.

The 25 Phase II geologic sequestration RD&D projects range in size from 43 tons of CO_2 in a single injection to approximately one million tons of CO_2 injected over a two to three year period, with most projects being a few thousand tones of injected CO_2. Phase III commercial scale demonstration projects will generally be in the range of one to five million tons of injected CO_2 at each site during a period of three to six years.

Legal Barriers Encountered in Phase II Projects

This section reports the legal issues that posed the most common and significant barriers to implementing Phase II projects: long-term liability, consents, and permitting.

Of the 25 Phase II geologic sequestration test injection projects, this study conducted a survey of the 19 projects for which data were available in order to assess the legal issues encountered. The survey questionnaire is presented in Appendix C to this study.

Frequency of Legal Barriers and Impact on Phase II RD&D Projects

Of the 19 pilot projects surveyed, 11 reported significant legal issues. These legal issues consumed substantial financial or personnel resources, to the point that they delayed or blocked research projects. Legal issues relating to liability have caused one project to be cancelled, forcing the lead research organization to locate a new site and start over.

Significantly, legal barriers were encountered in small projects. A majority of the projects in the 2,000 to 10,000 ton range of injected CO_2 and all of the projects above

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[11] Terrestrial carbon sequestration involves changing the management of forests, rangelands, agricultural lands, and wetlands in order to remove more CO_2 or reduce emissions of CO_2 from these ecosystems. This study does not look at the DOE Phase II terrestrial sequestration projects.

[12] U.S. Department of Energy (2008). http://www.fossil.energy.gov/programs/sequestration/partnerships/index.html (accessed on April 5, 2008).

10,000 tons of injected CO_2 reported some kind of significant legal barrier. Only for volumes of 1,000 tons or less of injected CO_2 were legal issues largely absent.

Projects Reporting Legal Barriers by Injection Volume

CO_2 Injection Volume in Tons	**1,000 or Less**	**2,000 to 3,000**	**10,000**	**30,000 to 50,000**	**300,000+**
Number of Projects	5	7	2	2	3
Number Reporting Legal Barriers	1	4	1	2	3

According to survey respondents, the time devoted to non-research functions (legal, permitting, administrative) ranged from 5% to as high as 90% of overall personnel time where significant legal issues were encountered. In no cases were research staff trained to deal with legal issues. In several cases, private parties participating in the various Regional Sequestration Partnerships Program expended substantial resources to assist the research organizations in resolving property rights and legal liability issues, and obtaining consents.

The prevalence of legal barriers for RD&D projects at relatively small injection volumes, even where risks associated with health and safety, property damage and CO_2 leakage were widely acknowledged by stakeholders to be negligible, suggests that future RD&D projects will continue to face significant legal hurdles. The experience gained in Phase II provided important information to identify the regulatory barriers to implementing CCS (which is one of the goals of the DOE program). Research organization staff time and resources devoted to addressing legal issues should be minimized in order to support and advance CCS research in Phase III and future research programs.

Types of Liability

Liability issues appear in different contexts that should be distinguished because only certain types of liabilities posed barriers to CCS research in Phase II. The categories used here are ordinary liabilities associated with the conduct of firms providing commercial services, and longer-term liabilities associated with potential damage to property and life as a result of sequestration activities.

The first category of liability/indemnification issues relating to the conduct of commercial firms providing services, such as drilling and injection services, did not pose a barrier to Phase II research and this study did not produce any evidence that this type of liability will pose a barrier to future research projects. Service providers are already subject to a duty of care defined under tort law and are typically subject to standards of conduct imposed under their contractual arrangements. Companies providing specific services have experience in their industries, and are appropriately subject to liability for worker safety and property damage resulting from their conduct. These companies are best positioned to manage the risks associated with their own conduct and are able to obtain liability insurance for their conduct and workers. In the survey and our case studies, companies were willing to provide services on a commercial basis and generally willing to accept liability for their actions. Accordingly, these types of liabilities are not included within the scope of the liability shield proposed by this study.

The legal barriers encountered in the Phase II projects associated with liability relate to long-term permanent sequestration of CO_2, specifically health and safety risks, potential property damage (land and minerals), leakage of CO_2 and potential tort liability for trespass of CO_2 into other property. Appendix B to this study provides an overview of the health and safety, environmental, property and tort laws that provide the legal basis for the long-term liabilities that are of concern here. Potential long-term liability posed significant barriers for active participants in Phase II projects, as well as passive participants, such as rights holders whose consent is required for a project. Lead research organizations, typically national laboratories or universities, are not appropriate parties to bear these liabilities and in at least some cases are unable to accept such responsibility. These types of liabilities are therefore within the scope of the liability shield and indemnification provision proposed by this study.

Long-Term Liability Issues

For small-scale Phase II projects, stakeholders generally acknowledged that the test injections posed very little risk to health and safety, or of property damage or trespass, due to migration or leakage of CO_2. Nevertheless, in 9 of the 14 projects surveyed for which data was provided on liability issues, long-term liability was an issue of negotiation. Six projects resolved their liability issues because private parties accepted responsibility for potential long-term liability. Inability to resolve liability issues caused one project to be cancelled, forcing the lead research organization to locate a new site and start over. In 5 projects, the liability issue was not raised yet parties are proceeding with those projects. At the time of writing, 2 projects are still negotiating liability issues, two projects have not started negotiating (thus no data are available), and 3 projects declined to comment on the liability issue.

Phase II Projects: Occurrence and Outcome of Long-Term Liability Issues

Outcome	Number of Projects
Liability Assumed by Project Party	6
Liability Not Raised in Negotiations	5
Liability being Negotiated – No Result Yet	2
Project Cancelled Due to Liability	1
Declined to Comment	3
No Data – Negotiations Not Started	2

Where liability issues occurred in Phase II projects, they consumed significant research organization staff time and resources. The liability issues proved to be difficult to resolve because of the inability to demonstrate a limit to liability in amount or time based on past experience, and because the lead research institutions contracted to conduct the Phase II projects were not authorized to, and would not ordinarily be expected to, indemnify third parties for potential liabilities associated with research projects. Significantly, liability issues can be expected to increase in importance for larger Phase III research and commercial CCS projects.

Insurance was sought in at least two Phase II projects as a means to address potential liability; however, long-term insurance is not currently available for CCS activities. For a commercial scale project, insurance is likely to be essential.

Consents

The Phase II projects surveyed appropriately sought consents from surface and subsurface rights holders (mineral rights owners and lessees). None of the projects sought consents from rights holders in neighboring properties because the paths of the CO_2 injection plumes are expected to be within the injection site properties for all projects.

The ability to obtain consents is closely linked to resolving long-term liability issues. In 6 of the 19 projects, rights holders provided consent in return for receiving indemnification to protect them against harm or liability. In one instance, the inability to resolve liability issues resulted in a project being unable to obtain consents and to it being cancelled, requiring researchers to start over at a new site. Two projects are still negotiating for consents, 2 projects have not yet started negotiation, and 3 projects declined to comment on the consents issue.

Six projects reported demands by property rights holders for compensation for the use of, or immediate impact on, their property. These property rights holders included surface and subsurface owners and lessees of the project site. In contrast to long-term liability issues that led to requests for potentially open-ended indemnification, compensation demands were limited in amount and based on market terms (e.g., rental of pad space for injection equipment).

The survey revealed that some of the partnerships experienced significant difficulty obtaining consents from all required parties for Phase II projects. Obtaining consents from the various parties that may hold property rights in a CCS site (e.g., surface owners, mineral rights holders, mineral rights lessees, water users) required considerable time and expense in some cases.

In Phase III, injections of larger quantities of CO_2 will likely require consents from a greater number of rights holders as the size of the CO_2 plume increases. In turn, this will increase the complexity of obtaining consents for CCS projects.

Evidence from Phase II suggests that resolving long-term liability issues is a necessary step to encouraging rights holders to provide the consents required for RD&D projects. No conclusion can be drawn based on Phase II as to whether further measures, such as the exercise of eminent domain, would be necessary to address the consent issues for the larger scale CCS research projects to be undertaken in Phase III. The study results also suggest that additional financial and personnel resources will be increasingly important to obtain consents for larger projects involving multiple rights holders, although these resources may continue to be provided by private sector research partners.

SDWA Permits

The time and cost associated with preparing SDWA permit applications, and the time required for agency review, have caused delays and can impose burdens on small-scale research projects due to limited personnel and financial resources.

Although the EPA issued guidance recommending that injection permits be issued as Class V experimental Underground Injection Control (UIC) test wells,[13] for the 19 pilot tests surveyed (1 project involving 2 injections at different strata for a total of 20 injections), 12 permits have been issued or are expected to be issued as Class II permits for EOR/EGR injections. Interviews revealed that decisions concerning the class of UIC permit applications were typically based on the type of activity most closely associated with the injection (e.g., EOR/EGR) and the recommendations of partners and the government agencies issuing the injection permits. Interviewees commonly cited greater experience with CO_2 injection under EOR/EGR-related Class II permits and their perception that Class II permits are easier to obtain than Class V permits.

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[13] U.S. Environmental Protection Agency, UIC Program Guidance No. 83, "Using the Class V Experimental Technology Well Classification for Pilot Geologic Sequestration Projects," March 1, 2007, *available at* http://www.epa.gov/safewater/uic/pdfs/guide_uic_carbonsequestration_final-03-07.pdf.

Phase II Project Wells by Formation Type and UIC Class

	Oil & Gas	Coal	Saline	Total
Class II	7	4	1	12
Class V	1	1	6	8
Total	8	5	7	20

Note: The survey includes the Calpine-Rosetta project as it was originally planned before its cancellation. As planned, it would have involved 2 injections at different levels in a stacked saline aquifer and gas field, requiring two permits, for a total of 20 permits for the 19 projects surveyed.

EPA review of permit applications is generally expected to require between 6 to 9 months based on EPA estimates provided to certain of the partnerships in informal consultations. State agency review under Class II, where available, is expected to require less time, in some cases requiring only 1 to 2 months.

The lack of uniformity inherent in the SDWA UIC program also poses challenges for the research partnerships. Under the UIC program, some states have primacy for all classes of wells, some states have primacy for Class II wells, some states have primacy for all classes of wells except Class II, and some state UIC programs are operated by the regional U.S. EPA office. Where states administer the program, authority is held by oil and gas divisions or environmental protection agencies, depending upon the class of permit. These agencies may take differing approaches to the protection of drinking water under the SDWA. Each project will therefore involve different regulators and permitting strategies depending upon the regulatory framework governing the particular project.

Permitting requirements imposed significant demands on staff time for some of the partnerships, and the uncertain duration of the permitting review process complicated planning decisions for others. The resources required to prepare permits for small-scale research projects could decrease in the future as researchers and regulators gain experience in permitting CCS-related activities. As described below, this study recommends that EPA consider streamlined review procedures for small-scale research projects based on the experience gained in Phase II.

Role of Private Sector and EOR/EGR in Phase II Projects

Private sector parties participated in all of the Phase II projects, demonstrating the important role that the private sector plays in sequestration research. Private sector expertise and resources will continue to be essential in supporting Phase III sequestration projects and in developing capture technologies, many of which are being tested at private sector plants.

The role of the EOR and EGR industries in supporting Phase II projects is particularly significant. For the 19 projects surveyed there were 20 injections (1 project involving 2 injections at different strata), 12 of which are EOR/EGR injections, and an additional 2 are on sites in which EOR or EGR activities are conducted. The predominance of EOR and EGR among Phase II projects reflects the advantage they enjoy compared to saline-formation sequestration due to the low cost of adapting existing commercial infrastructure for EOR and

EGR operations to CCS research, and the abundance of private financial and institutional support available for EOR/EGR-related RD&D.

EOR/EGR partners provided drilling and injection services to the projects. In several cases, they also expended significant resources to resolve legal issues. EOR/EGR mineral rights holders, operating companies, and drilling companies accepted long-term legal liability in all 6 cases in which these issues were raised and have been successfully resolved. In these 6 projects, 4 of the projects involve injection volumes up to 3,000 tons of CO_2 and 2 involve injection volumes over 50,000 tons of CO_2. Five of 6 of these projects, including the 2 larger ones, are EOR/EGR related projects in which the party accepting liability has an economic incentive in the petroleum or gas to be produced or is a service provider. In the one non-EOR/EGR project, a drilling company established in the EOR/EGR field accepted liability. Notably, the 5 projects in which liability was not raised in negotiation are all EOR/EGR projects, which may indicate that liability is not a significant issue for the EOR/EGR industry for the types of injections in Phase II.

Power generators have partnered in 4 of the 7 saline Phase II projects. Like EOR/EGR partners, they have provided resources to resolve legal issues. However, at the time of writing, no generator has accepted liability for their projects.

Case Studies of Two Phase II Projects

The case studies examined in this study provide an example of a successfully completed project and a withdrawn project. These cases show that the resolution of legal issues significantly affects project outcomes.

Both cases are drawn from the DOE Phase II small-scale geologic sequestration test injection projects surveyed in this study: the Otsego County, Michigan pilot test conducted by the Midwest Regional Carbon Sequestration Partnership (MRSCP), and the Calpine-Rosetta injection project operated by the West Coast Regional Carbon Sequestration Partnership (WESTCARB) through the Lawrence Berkeley National Laboratory (LBNL).

Otsego County, Michigan Pilot Test

The Otsego County, Michigan test injection is the first Phase II project in a deep saline formation to be completed under the DOE program. The injection was completed during Spring 2008.

This project is located near Chester Township in Otsego County, Michigan. The purpose of the project is to assess the potential of carbon sequestration in the Bass Island Dolomite and Bois-Blanc layers, an important sequestration target in the Michigan Basin.

This project involves injection of approximately 10,000 tons of CO_2 into a deep saline formation located about 3,190 to 3,515 feet below ground for permanent storage. The plume is expected to be less than 500 feet from the injection site, which is well within the property boundaries.[14] The test site is within a much larger oil and gas production site.[15] Oil production using CO_2 EOR methods is taking place separately on the same property at a depth of about 5,500 feet.

The surface and mineral rights are owned by the Michigan Department of Natural Resources. The mineral rights have been leased to Core Energy, an oil production company, which conducts CO_2 EOR activities on the property and is providing drilling and injection services to the test project.

Battelle Memorial Institute operates the project under contract with the DOE. DTE Energy, a utility, provides financial support to the project and provides the CO_2 for injection collected from its Turtle Lake gas processing plant. Both the EPA and the Michigan Department of Environmental Quality issued permits for the test injection.

The project proponents declined to comment on long-term liability and indemnification issues. The project enjoyed support from those stakeholders directly involved. The Michigan Department of Natural Resources that owns the land was supportive of the project's research goals and viewed the CCS activity as similar in nature to EOR activity that is already occurring on other parts of the property with its approval. As noted above, the mineral rights lessee also supports the project by providing drilling and injection services, and is engaged in EOR on the property.

The only significant legal barriers reported in this case resulted from a challenge to the EPA issuing a Class V UIC permit to Core Energy to undertake the injection.[16] A petitioner who is a resident of Otsego County located about a mile outside the quarter mile regulatory Area of Review opposed the permit, on the grounds that there was an "absence of a clear policy addressing potential liability for any damages that might result from the permitted activity,"[17] and that the permit potentially violates the rights of adjacent property owners because the operation of the well would result in subsurface trespasses.[18]

The Environmental Appeals Board (EAB), which hears challenges to certain EPA actions, denied the petition for review on December 19, 2007, and denied a motion for reconsideration on January 15, 2008. In its first decision, the EAB declined to rule on the liability question on the grounds that it had not been raised during the public comment period and so had not been preserved for appeal. With respect to the property rights claim, it held that EPA does not have authority under SDWA to adjudicate surface, mineral, or storage rights when issuing permit decisions. Citing EPA's submission, EAB noted that "Issues relating to property ownership or lessee rights are legal issues between the permittee and property owners."[19] These property rights issues are governed by state law.

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[14] Neeraj Gupta, Battelle Memorial Institute, personal communications, May 6, 2008.

[15] Project Facts: Midwest Regional Carbon Sequestration Partnership – Validation Phase, U.S. Department of Energy, National Energy Technology Laboratory, April 2008, *available at* http://www.netl.doe.gov/publications/factsheets/project/proj445.pdf.

[16] See In re Core Energy, LLC, UIC Appeal No. 07-02 (E.A.B., December 19, 2007).

[17] *Id.* at 7.

[18] *Id.* at 9.

Rosetta-Calpine Carbon Sequestration Project, Thornton, California

The Rosetta-Calpine Carbon Sequestration Project is an example of a project that was cancelled in part due to the legal issues described in this study.

This project was to be located in the Sacramento Valley on a site over an abandoned gas field in Thornton California. Gas production at the site began in the mid 1940s and continued through the late 1980s, producing 53.6 billion cubic feet from 15 production wells.

The purpose of the project was to assess CO_2 storage potential in the Sacramento Valley. The project was located near the partially depleted Rio Vista gas field, which is the largest gas field in California and possesses an estimated 1.7 Gt CO_2 storage capacity alone.[20]

The site was selected from among eight sites assessed in the Southern Sacramento Basin based on safety, technical and logistical criteria, and favorable results from EGR studies. EGR involves a similar CO_2 injection process to EOR, but relies on reservoir repressurization or pressure maintenance and methane displacement to produce additional natural gas.

The project site is zoned for agricultural use and is leased for farming. It is located in a rural location half a mile from the closest residence. The property is bounded by agriculture to the south, east and west, and to the north by the Cosumnes River Preserve, which is operated by The Nature Conservancy, a non-profit conservation group. The preserve is the winter home for migratory birds, including at least one listed as threatened by the state of California.

This project would have injected approximately 2,000 tons[21] of CO_2 into a saline formation located approximately 3,500 feet to 5,000 feet underground. A second test of an additional 2,000 tons of injected CO_2 into a depleted natural gas reservoir formation located above the saline formation at approximately 3,000 feet below ground was also contemplated.

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[19] *Id.* at 9.

[20] Robert Trautz, Sally Benson, Larry Myer, Curtis Oldenburg, Ed Seeman, Eric Hadsell, and Ben Funderburk, "The Rosetta Resources CO_2 Storage Project – A WESTCARB Geologic Pilot Test" (January 30, 2006). Lawrence Berkeley National Laboratory. Paper LBNL-59655, *available at* http://repositories.cdlib.org/lbnl/LBNL-59655.

[21] This is the amount of CO_2 generated by a typical 1,000-megawatt (MW) coal-fired power plant in approximately 2.2 hours. CO_2 is highly compressible, its density influenced by pressure and temperature. At injection depths, pressure is approximately 1,500 pounds per square inch (102 atmospheres) and the temperature is approximately 130°F. Under these conditions, 2,000 tons of CO_2 would have a volume of about 200,000 cubic feet or about the size of a football field 3.5 feet deep. Lawrence Berkeley National

A single injection well, cased in cement and perforated to permit fluid flow into and out of the formation, was to be used for injection into both the saline formation and the depleted gas reservoir. A separate observation well was to be fitted with monitoring equipment. Following drilling, the geologic features of the wells would be logged in open hole and cased condition, and baseline conditions characterized including fluid sampling, geophysics, soil gas survey, and reservoir pressure. Upon completion of the project, the wells would be abandoned in accordance with California State law and the site would then be restored.

The site landowner is a state government entity. A multinational insurance and financial company owns the subsurface rights, which in turn leased these rights to Calpine Corporation, a publicly-traded independent power producer. Calpine entered into an agreement to undertake and support the pilot project by contributing drilling and other services. Calpine later transferred its subsurface property rights to Rosetta Corporation, a gas exploration and production company, along with the obligation to support the project. LBNL provided technical leadership for carrying out the project, including conducting modeling, monitoring and verification of the pilot tests, and assisting in preparing permit applications. A private third party company would provide injection and project management services.

Consents were sought from the rights holders of the property on which the injection site was located. The injected CO_2 was not expected to migrate across the property boundaries. Both the state government landowner and the mineral rights holder sought indemnification for any liabilities that could occur in connection with the project. The mineral rights owner also sought full indemnification, including for potential damages to its mineral rights. Rosetta and the injection services company, both of which are experienced companies in the gas industry, were both willing to conduct drilling and injection activities without indemnification for those specific activities.

EPA Region IX has jurisdiction over most SDWA approvals in California, except for the California State Department of Oil, Gas and Geothermal Resources (DOGGR), which retains jurisdiction over extraction or injection involving oil and gas reservoirs. LBNL had planned to prepare and file a Class V UIC permit application with EPA Region IX for the injection into the saline formation, and to prepare and submit an injectivity permit application within the Class II permit regulations for the injection into the depleted natural gas reservoir. The project was cancelled before an application was prepared and submitted to EPA or DOGGR for permits, however, the project parties had informally consulted these agencies in advance.

Laboratory (2008), Project Description: Arizona Utilities CO_2 Storage Pilot Project (Draft dated March 2008) (on file with the author).

Several of the stakeholders expressed the view that injection of 2,000 tons of CO_2 does not present any significant health and safety risks. Although the risks were widely viewed as minimal, the liability issues proved to be a significant barrier to this project. No private party partner possessed the economic incentive, and LBNL and DOE lacked authority, to indemnify project participants for potential liabilities. Without the ability to resolve these issues, key participants in the project withdrew, ultimately causing the project to be cancelled.

Permitting did not appear to be a major obstacle, although there was concern about the amount of research organization staff time and other resources required to obtain permits.

LBNL is now working with new partners at a new test location in the Sacramento Valley to develop a Phase II injection project to replace the Calpine-Rosetta project.

Recommendations for Advancing CCS Research

The Phase II pilot projects involved very little risk to health and safety, or of property damage or trespass, due to migration or leakage of CO_2, yet they encountered significant legal barriers, sometimes requiring substantial commitments of personnel time and financial resources to resolve. Long-term liability issues appear to be the primary barrier to advancing CCS RD&D research. The experience gained in Phase II strongly suggests that liability issues will pose significant barriers to advancing CCS research in Phase III.

In all 6 Phase II projects in which liability issues have been raised and resolved, EOR/EGR mineral rights holders, operating companies, and drilling companies that had an economic interest in the petroleum or gas produced or in providing services accepted long-term liability. These were relatively small projects under 3,000 tons or larger projects in which the injection of CO_2 was for EOR/EGR purposes and the economic incentives were substantial.

In Phase III, CO_2 injection volumes increase significantly and saline formation projects are the focus of research. Private parties may not continue to voluntarily accept liability in Phase III saline-formation projects that do not involve strong economic incentives such as those associated with EOR/EGR projects. In the absence of strong private economic incentives, saline formation research is an appropriate priority for government support because saline formation capacity is estimated to represent as much as 84% of geologic storage capacity in the United States.[22]

Policies such as cap-and-trade and carbon taxes can generate support for various greenhouse gas mitigation technologies, including CCS. However, in the absence of or in addition to such economy-wide policies, government policies specifically addressing the barriers to CCS RD&D are necessary to promote maturation of the CCS industry. Once a commercial CCS industry exists, policies such as a carbon tax or cap-and-trade system would then promote market adoption of CCS technologies.

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[22] U.S. Environmental Protection Agency, Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells, EPA-HQ-OW-2008-0390 FRL-8695-3, July 15, 2008, 73 Fed. Reg. 43492 (July 25, 2008).

Government can advance CCS by providing a legal framework that addresses the barriers to CCS RD&D identified in this study. Most importantly, this study recommends a shield protecting research organizations and other organizations supporting research; and government indemnity to protect and make whole property rights holders, parties granting consent to projects, and third parties who may be affected by CCS research. It also recommends that EPA provide a simplified approval process under the SDWA for qualifying small-scale injections.

Liability Shield and Government Indemnification for CCS RD&D Projects

A statute shielding research organizations and organizations supporting research from legal liability would provide important support for the further development of CCS. Where research organizations and supporting organizations either lack a commercial motivation or they are not permitted to accept liability (as is frequently the case for research institutions), shielding these parties from liability will be essential.

A liability shield should be coupled with government indemnification to protect and make whole property rights holders, parties granting consent to projects, and third parties who may be affected by CCS research. The liability shield and indemnification provisions would be limited in scope, dollar amount and duration.

The scope of the liability shield and government indemnification provision could be limited in a number of ways. They should cover only CCS RD&D activities (e.g., test injections, monitoring, measurement and verification, demonstration) that result in public disclosure and dissemination of data. The liability shield and government indemnification provision should only cover long-term and property-related liabilities because these liabilities pose potentially significant barriers to CCS research. The provision of commercial services, such as drilling and injection services, would not be included within the scope of the liability shield and indemnification provision proposed here. Only RD&D-phase liabilities would be covered; if a RD&D project is converted to commercial sequestration, the liability provisions should no longer be available. The liability shield and indemnification provision could also be limited to non-EOR/EGR sequestration, in particular saline formations which lack the economic incentives associated with EOR/EGR applications.

Qualifying projects could also be subject to a number of technical conditions designed to protect health and safety, and to reduce government exposure to potential liability under an indemnification provision. These requirements could include limits on volume of injection, depth of injection, purity of injectate, and proximity to underground sources of drinking water, human settlements, or ecologically sensitive areas. The DOE possesses resources in the national laboratories to provide guidance for establishing appropriate technical conditions.[23] Other prudential conditions for a project to qualify for the liability shield and government indemnity could include management by a recognized national laboratory, university, or private entity approved by the DOE; and DOE project approval.

The private sector possesses important capabilities and resources that are necessary to support CCS research. The liability shield and indemnification provision should extend to protect private parties to the extent they participate in a qualified research program for long-term liabilities associated with sequestration. However, as noted above, this coverage should not relieve commercial service providers of potential liability for their conduct based on legal and contractual duties of care. The precise balance between these two principles would need to be established in legislation.

The duration of the liability shield and government indemnification would be limited to projects initiated during the period authorized by Congress. The protections provided by the liability shield and indemnification provisions should be available indefinitely to qualifying projects. As noted above, however, if a RD&D project is converted to commercial sequestration, the liability provisions should cease to be available.

Finally, the indemnification provision proposed here would be limited in dollar amount. The specific amount authorized for the government indemnification provision are beyond the scope of this study and would require further evaluation of future CCS research needs, including the Phase III RD&D projects. However, it is important to note that the amount should be limited and need not compete with supporting other priorities, such as renewable energy. Congress possesses several funding options that do not necessarily compete with other priorities, including imposing a charge on industry that would employ CCS technology in the event of a claim against the government indemnification provision, an allocation of allowances or credits under a cap-and-trade system that would provide revenues to support a special fund, or funding from general tax revenues in the event a claim is made.

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[23] See Curtis M. Oldenburg and Steven L. Bryant, Certification Framework for Geologic CO_2 Storage, Sixth Annual Conference on Carbon Capture and Sequestration, National Energy Technology Laboratory, Pittsburgh, PA, May 7-10, 2007 available at www.netl.doe.gov/publications/proceedings/07/carbon-seq/data/papers/tue_062.pdf; Curtis M. Oldenburg, Steven L. Bryant, Jean-Philippe Nicot, and Ying Zhang, Certification Framework for Geologic Carbon Sequestration Based on Effective Trapping, Seventh Annual Conference on Carbon Capture and Sequestration, National Energy Technology Laboratory, Pittsburgh, PA, May 5-8, 2008; Curtis M. Oldenburg, Steven L. Bryant, Jean-Philippe Nicot, Certification Framework for Geologic Carbon Sequestration Based on Effective Trapping (forthcoming 2009).

Examples of Government Indemnification for Third Party Liability

There is no government-wide legislation providing for indemnification of federal government contractors for third-party liability. In certain cases, however, the U.S. federal government does indemnify contractors for third party liability for research and development contracts. These examples provide precedent for a government indemnification provision for CCS-related RD&D activities.

Congress has authorized certain departments and agencies to indemnify contractors for certain types of risks. These authorizations are typically for hazardous activities or the national defense. Examples include the National Defense Contracts Act[24] that provides for indemnification for unusually hazardous or nuclear risks under defense contracts; Armed Forces procurement law that provides for indemnification for unusually hazardous defense research and development activities;[25] the Federal Aviation Act[26] that provides for indemnification for aircraft operations in carrying out U.S. foreign policy; and the National Aeronautics and Space Act[27] that provides for indemnification for the launch, operation or recovery of space vehicles.

The Atomic Energy Act, as amended by the Price-Anderson Act of 1957, provides for mandatory indemnification of contractors for activities involving the risk of a substantial nuclear incident up to an aggregate limit of $10 billion.[28] The indemnification provision has been extended periodically, most recently by the Energy Policy Act of 2005 for another 20 years. Nuclear operators are required to obtain the maximum amount of insurance against nuclear related incidents available in the insurance market; claims above insured amounts would then be satisfied by the government indemnification provision up to the statutory limit, which is financed by contributions from the nuclear reactor operators in the event of an accident.

The Price-Anderson Act indemnification provision covers DOE contractors and their subcontractors for nuclear RD&D projects. DOE has issued indemnification language to be included in its contracts, which specifies that the contractor shall be indemnified for personal injury and property damage claims as a result of negligence or other bases of liability, excluding willful misconduct.[29]

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[24] 50 U.S.C. § 1431 et seq. (2008), as implemented by Executive Order 10789.

[25] 10 U.S.C. § 2354 (2008).

[26] 49 U.S.C. § 1531 et seq (2008).

[27] 42 U.S.C. § 2458b et seq (2008).

[28] 42 U.S.C. § 2210(d).

[29] 48 C.F.R. § 952.250-70.

Streamlined Review under SDWA

The time and cost associated with preparing SDWA permit applications, and the time required for agency review, have caused delays and imposed burdens on Phase II projects due to limited financial and staff resources.

The EPA's proposed rule for CCS injections under the SDWA released in July 2008 contains no provision for small-scale test injections performed prior to full permitting for purposes of research or characterizing the geology of a proposed well.[30] The preamble to the proposed rule does, however, provide that Class V experimental well classification will remain available for those pilot-projects that continue to qualify under Class V guidelines.[31]

This study's survey results suggest that the Class V experimental well provision was disfavored by Phase II project proponents who sought permits under Class II where available. Also, the lack of uniformity inherent in the SDWA UIC program posed challenges for the research community.

EPA should evaluate how research needs are currently handled under existing SDWA permit arrangements, and consider research provisions in its final rule for permitting CO_2 injections for CCS. This study suggests that streamlined provisions for permitting small-scale CCS research and test injections under the SDWA could help facilitate research and development efforts. Streamlined permitting procedures would focus regulatory resources appropriately on large-scale injections, rather than on small injections that pose little or no risk to the environment.

Notably, the State of Washington's UIC program allows streamlined permitting under Class V for small-scale pilot injections of under 1,000 metric tons or larger volumes by application.[32] Australia has adopted a phased permitting process, which includes an assessment permit.[33] Other U.S. environmental laws also have adopted a streamlined review and permitting approach in non-CCS contexts.[34]

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[30] U.S. Environmental Protection Agency, Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells, EPA-HQ-OW-2008-0390 FRL-8695-3, July 15, 2008, 73 Fed. Reg. 43492 (July 25, 2008).

[31] U.S. Environmental Protection Agency, UIC Program Guidance No. 83, "Using the Class V Experimental Technology Well Classification for Pilot Geologic Sequestration Projects," March 1, 2007, *available at* http://www.epa.gov/safewater/uic/pdfs/guide_uic_carbonsequestration_final-03-07.pdf.

[32] Wash. Admin. Code, 173-218-115(4)(b).

[33] Nigel Bankes and Jenette Poschwatta, *Australian Legislation on Carbon Capture and Storage: A Canadian Perspective* (June 2008), *available at* www.iseee.ca/files/iseee/bankes_research_paper.pdf.

[34] For example, the Toxic Substances Control Act (TSCA), 15 U.S.C. § 2601 et seq. (2008), which governs the manufacture, processing, use, distribution in commerce, and disposal of chemical substances and mixtures, provides for varying levels of expedited review and exemption from regulations for qualifying research, low volume commercial production, and low release low exposure commercial production. See

A common feature of streamlined permitting schemes is a quantified limit, which in the case of CCS, would likely be a volume limit. The advantages of a quantified volume limit include that it provides greater certainty for research organizations. While no specific volume limit is suggested here, if EPA were to adopt such an approach, EPA should consider several factors for setting such a limit. A volume limit should be differentiated base on type of formation, site pressure, and other site-specific conditions. Such a limit could change (likely increase) along with our knowledge of a particular formation and experience with CO_2 injections for purposes of permanent sequestration. Finally, in addition to considerations relating to protection of drinking water sources, a volume limit should be based on the needs of advancing research and the risks to health and safety, including the general population, flora and fauna. CCS assessment models have been developed by our national laboratories specifically to address these kinds of risks.[35]

The Phase II projects have provided valuable experience about the CCS permitting process for small-scale CCS research projects. EPA should take account of this experience and consider providing an improved permitting regime for small-scale research projects in order to facilitate future CCS research and development efforts.

Conclusions

This study examined the legal and regulatory barriers to the Phase II projects of the U.S. Department of Energy's Regional Carbon Sequestration Partnerships Program. The barriers involved long-term liability, obtaining consents, and to a lesser extent Safe Drinking Water Act permitting. To overcome these barriers, this study recommends the federal government provide a legal framework that supports CCS research, specifically a liability shield for research organizations and organization that support research, and government indemnity for third parties including property rights holders, parties granting consent to projects, and those who may be affected by CCS research projects. It also recommends that the U.S. EPA consider adopting a simplified approval process under the Safe Drinking Water Act for research injections.

Elizabeth Brown et al., A Practitioner's Guide to the Toxic Substance Control Act, Environmental Law Institute, 1999.

[35] See Curtis M. Oldenburg and Steven L. Bryant, Certification Framework for Geologic CO_2 Storage, Sixth Annual Conference on Carbon Capture and Sequestration, National Energy Technology Laboratory, Pittsburgh, PA, May 7-10, 2007 available at www.netl.doe.gov/publications/proceedings/07/carbon-seq/data/papers/tue_062.pdf; Curtis M. Oldenburg, Steven L. Bryant, Jean-Philippe Nicot, and Ying Zhang, Certification Framework for Geologic Carbon Sequestration Based on Effective Trapping, Seventh Annual Conference on Carbon Capture and Sequestration, National Energy Technology Laboratory, Pittsburgh, PA, May 5-8, 2008; Curtis M. Oldenburg, Steven L. Bryant, Jean-Philippe Nicot, Certification Framework for Geologic Carbon Sequestration Based on Effective Trapping (forthcoming 2009).

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Appendix A: Phase II Geologic Sequestration Projects Included in Survey

Partnership	Name	Location	Formation
BigSky	Basalt Field Test	Walula, WA	Basalt
MGSC	Huff-Puff	Fayette County, IL	Sandstone
MGSC	Tanquary	Wabash County, IL	Coal Bed
MGSC	Imiscible Gas	Western, KY	Sandstone
MRCSP	Appalachian Basin	Shadyside, OH	Saline
MRCSP	Cincinnati Arch	Rabbithash, KY	Saline
MRCSP	Michigan	Otsego, MI	Saline
PCOR	Lignite	Bowbells, ND	Coal Seam
PCOR	Williston Basin	TBD	Carbonate
PCOR	ZAMA	Alberta, CA	Carbonate
SECARB	Cranfield	Cranfield, TX	Saline
SECARB	Appalachian	Russell County, VA	Coal Seam
SECARB	Black Warrior	Tuscaloosa AL	Coal Seam
SECARB	Plant Daniel	Escataba, MI	Saline
Southwest	Aneth	Blaning, UT	Carbonate
Southwest	San Juan	Farmington, NM	Coal
Southwest	SACROC	Snyder, TX	Carbonate
WESTCARB	Rosetta	Thornton CA	Saline
WESTCARB	Arizona	Flagstaff AZ	Saline

Appendix B: U.S. Federal and State Law Potentially Governing CCS Activities

This section briefly describes the SDWA and other major federal and state laws which could be interpreted to apply to various aspects of CCS, including RCRA, CERCLA, the Occupational Safety and Health Act (OSHA),[36] state laws governing health and safety, state law that governs property rights and tort liability, and federal government laws regarding indemnification of contractors for third party liability.

Safe Drinking Water Act

The SDWA[37] is intended to protect public drinking water supplies, including potential underground drinking water sources. The EPA has established through its UIC regulations that underground sources of drinking water are underground aquifers with less than 10,000 milligrams per liter (mg/L) total dissolved solids (TDS) and which contain a sufficient quantity of ground water to supply a public water system.[38]

The SDWA directs EPA to establish regulations setting minimum requirements for state water quality. States with permitting programs that meet EPA requirements are eligible to retain primary enforcement responsibility under SDWA. EPA administers SDWA in states that do not adopt an approved UIC program. With the exception of 10 state programs administrated by EPA and 7 states that administer their programs jointly with EPA,[39] all other states retain primary authority for administering SDWA.

SDWA requires applicants to obtain a permit to conduct an "underground injection" of substances under the UIC program. Permit applicants must demonstrate that the proposed underground injection will not endanger drinking water sources.[40] The statute provides that underground injection endangers drinking water sources,

> [i]f such injection may result in the presence in underground water which supplies or can reasonably be expected to supply any public water system of any contaminant, and if the presence of such contaminant may result in such system's not complying with any national primary drinking water regulation or may otherwise adversely affect the health of persons.[41]

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[36] 15 U.S.C § 651 et seq. (2008).

[37] 42 U.S.C. § 300f et seq.

[38] 40 CFR 144.3. Section 1421(b) (3)(A) of the Act also provides that EPA's UIC regulations shall "permit or provide for consideration of varying geologic, hydrological, or historical conditions in different States and in different areas within a State."

[39] U.S. Environmental Protection Agency, State UIC Programs, http://www.epa.gov/safewater/uic/primacy.html (accessed on August 7, 2008).

[40] See 42 U.S.C. § 300h(b)(1)(B).

[41] 42 U.S.C. § 300h(d)(2).

Although carbon dioxide that is injected into a properly sited and regulated formation is anticipated not to come into contact with underground sources of drinking water, the potential exists that carbon dioxide may cause acidification of drinking water, displace brine which could then come into contact with drinking water, or carry with it metals and other sediments that can contaminate drinking water. Even rendering water unpalatable can be cause for finding a substance to be a contaminant, as unpalatable water may cause people to seek unsafe sources of water.[42]

UIC permits for underground injections are classified based on the type of injection. Classes I, II and V are candidates for CO_2 injection wells:

- Class I injection wells are used to dispose of hazardous waste, non-hazardous industrial waste, municipal wastewater, and deep radioactive waste.[43]
- Class II injection wells are used for injections of fluids for disposal that are associated with oil and natural gas activities and injections for EOR/EGR.
- Class III injection wells inject fluids for mineral extraction.
- Class IV injection wells are used for hazardous or radioactive waste within a quarter mile of, into or above, underground safe drinking water.[44]
- Class V covers injections that are not covered by the other classifications, including experimental wells.[45]

In March 2007, EPA issued preliminary guidance under the UIC program for permitting demonstration CCS projects. The guidance encourages use of the Class V experimental well category, and provides guidelines for site selection, the appropriate "area of review," operational and monitoring procedures, and site closure.[46] The specific requirements for CCS research wells under the Class V category are being developed as regulators receive and review applications filed by the DOE partnerships.

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[42] Kipp Coddington, Robert Mowrey, Geir Vollsaeter, and Kristin Holloway Jones, CCS Issues under the Safe Drinking Water Act, dated May 10, 2008 (on file with the author), citing legislative history of the SDWA at 41 Fed. Reg. 36730, 36733 (August 31, 1976).

[43] There are no known radioactive waste disposal wells operating in the United States. See http://www.epa.gov/ogwdw000/uic/wells_class1.html#what_is (accessed October 12, 2008).

[44] In 1984, EPA banned the use of Class IV injection wells for disposal of hazardous or radioactive waste. These wells may now only be operated as part of an EPA- or state-authorized ground water clean-up action. There are approximately 32 waste clean-up sites with Class IV wells in the United States. See http://www.epa.gov/ogwdw000/uic/wells_class4.html#what_is (accessed October 12, 2008).

[45] 40 C.F.R. § 144.6.

[46] U.S. Environmental Protection Agency, UIC Program Guidance No. 83, "Using the Class V Experimental Technology Well Classification for Pilot Geologic Sequestration Projects," March 1, 2007, *available at* http://www.epa.gov/safewater/uic/pdfs/guide_uic_carbonsequestration_final-03-07.pdf.

In July 2008, following its review of the UIC permitting program in relation to CCS, EPA issued a proposed rule for commercial CCS injection wells under the SDWA UIC program. The proposed rule would create a Class VI injection well for permanent geologic sequestration of certain carbon dioxide streams. The proposed rule includes the following elements:

- Geologic site characterization to ensure that sequestration wells are appropriately sited;
- Requirements to construct wells with injectate-compatible materials in a manner that prevents fluid movement into unintended zones;
- Periodic re-evaluation of the area of review around the injection well to incorporate monitoring and operational data and to verify that the CO_2 is moving as predicted within the subsurface;
- Testing of the mechanical integrity of the injection well, ground water monitoring, and tracking of the location of the injected CO_2 to ensure protection of underground sources of drinking water;
- Extended post-injection monitoring and site care to track the location of the injected CO_2 and monitor subsurface pressures;
- Financial responsibility requirements to assure that funds will be available for well plugging, site care, closure, and emergency and remedial response; and
- Recordkeeping and reporting.[47]

Under the proposed rule, EPA proposes to retain availability of Class II injection well treatment for EOR/EGR activities provided these wells are still producing oil or gas. The proposed rule will also grandfather the construction of existing wells that have been permitted under Classes I, II or V, but will impose additional Class VI conditions on these wells and operations if they are later used for permanent carbon sequestration purposes.

To qualify under the new Class VI category, eligible CCS projects must: meet specific geologic requirements for the injection and confining zones (e.g., presence of cap rock, depth, absence of faults and fractures, pressure); include an analysis of projected path of injection plume; and include a detailed characterization of the injection formation in advance of permitting. The proposed rule calls for extensive pre-injection characterization and periodic post-injection monitoring for a 50-year default period or until the plume stabilizes.

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[47] U.S. Environmental Protection Agency, Office of Water, "EPA Proposes New Requirements for Geologic Sequestration of Carbon Dioxide." EPA 816-F-08-031. July 2008, *available at* http://www.epa.gov/safewater/uic/pdfs/fs_uic_co2_proposedrule.pdf.

RCRA, CERCLA, and NEPA

Carbon sequestration will also implicate several major federal environmental laws. This section briefly reviews RCRA and CERCLA because these laws are potentially directly applicable to carbon sequestration activities. The National Environmental Policy Act (NEPA)[48] is also reviewed here as it is applicable to CCS activities where there is federal involvement.[49] OSHA is also broadly applicable to CCS activities and is covered in its own section below. Other laws such as the Clean Water Act (which governs surface waters), the Clean Air Act, the Toxic Substances Control Act, the Pollution Prevention Act, the Endangered Species Act, the National Historic Preservation Act (where sites contain landmarks or archeologically significant items) could also potentially be applicable to a carbon sequestration project.

Currently, no U.S. federal law or regulation classifies CO_2 as a "waste".[50] However, in its 2008 proposed rule on SDWA, EPA noted that whether a CO_2 injection in a CCS project will trigger potential liability under RCRA or CERCLA will depend upon whether the CO_2 stream could contain other substances that are hazardous and could cause the CO_2 stream to be hazardous waste for purposes of RCRA, or contain hazardous substances or react to become a hazardous substance under CERCLA.[51]

RCRA[52] creates the framework for the cradle to grave management of hazardous and nonhazardous solid waste. RCRA established three programs: (a) the solid waste program, which encourages states to develop comprehensive plans to manage nonhazardous industrial solid waste and municipal solid waste, sets criteria for municipal solid waste landfills and other solid waste disposal facilities, and prohibits the open dumping of solid waste; (b) the hazardous waste program, which establishes a system for controlling hazardous waste from the time it is generated until its ultimate disposal; and (c) the underground storage tank program, which regulates underground storage tanks containing hazardous substances and petroleum products.

CERCLA,[53] commonly known as the Superfund law, authorizes the federal government to take action to clean up releases or threatened releases of hazardous substances that may endanger human health or the environment. CERCLA references four other federal statutes to designate over 800 substances as hazardous and to identify many more as potentially hazardous due to their characteristics and the circumstances of their release. CERCLA enables EPA to clean up sites contaminated with hazardous substances and seek compensation from responsible parties, or compel responsible parties to cleanup sites themselves. CERCLA liability potentially extends to current owners and operators of a facility, past owners and operators at the time hazardous wastes were disposed of, and generators and transporters of hazardous wastes. A responsible party may be able to avoid liability through specifically enumerated defenses, including that a release qualifies as a "federally permitted release" as defined under CERCLA.[54]

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[48] 42 U.S.C. § 4321 et seq. (2008).

[49] State environmental protection laws similar to NEPA may also apply where there is significant state or local government involvement in, or approval of, a CCS project.

[50] Massachusetts v. Environmental Protection Agency, 549 U.S. 497 (2007), declared atmospheric emissions of CO2 to be an "air pollutant" under the Clean Air Act.

[51] U.S. Environmental Protection Agency, Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells, EPA-HQ-OW-2008-0390 FRL-8695-3, July 15, 2008, 73 Fed. Reg. 43492 (July 25, 2008).

[52] 42 U.S.C. § 6901 et seq.

[53] 42 U.S.C. § 9601 et seq.

NEPA requires federal agencies to conduct assessments of major federal actions that may significantly affect the human environment. NEPA involves three levels of analysis. At the first level, an undertaking may be categorically excluded from a detailed environmental analysis if it meets certain criteria that a federal agency has previously determined as having no significant environmental impact. At the second level of analysis, a federal agency prepares a written Environmental Assessment (EA) to determine whether or not a federal undertaking would significantly affect the environment. If the EA results in a finding that a significant impact on the environment could occur, NEPA then requires a detailed Environmental Impact Statement (EIS). The EIS must include analysis of the environmental impact of the proposed action, unavoidable adverse environmental impacts, alternatives (including no action), short-term uses of the environment and its long-term preservation, and secondary and cumulative effects of implementing the action. Most of the Phase II projects received a categorical exclusion during the NEPA process based on determinations that they would have no significant environmental impact. However, the Phase III projects are all required to complete Environmental Assessments or Environmental Impact Statements due to the nature and scope of the actions.

Public and Workplace Health and Safety Laws

Exposure to carbon dioxide in high concentrations poses risks to human health, animals, and vegetation. For small-scale research projects, the safety of workers is probably the most immediate concern as workers engaged in drilling and injection activities have the greatest potential exposure to CO_2.

Worker health and safety is regulated under both federal and state law. OSHA requires employers to provide a workplace free from serious recognized hazards and to comply with occupational safety and health standards. The Act authorizes states to establish their own safety and health programs provided standards are at least as strict as federal standards. Twenty-three states operate OSHA-compliant programs covering private sector workers as well as state and local government employees.[55]

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[54] 42 U.S.C. § 9607 governs liability under CERCLA. Specifically, 42 U.S.C. § 9607(b) provides general enumerated defenses to liability, and other provisions of section 9607 provide defenses available to specific classes of parties and activities.

Research on the impact of exposure levels of CO_2 on human health show that relatively low concentrations of approximately 5% for extended periods can cause adverse physiological effects.[56] Pursuant to OSHA, the National Institute for Occupational Safety and Health sets workplace exposure guidelines for chemicals, including CO_2. OSHA regulations limit CO_2 exposure in the workplace to an average of less than 5,000 parts per million (0.5%) for a 40-hour workweek.[57]

Tort laws described further below also define public and workplace standards of care in the areas of worker health and safety. Laws governing transportation of CO_2 (e.g., by pipeline, rail and truck), injection into high-pressure CO_2 formations, and experience in CO_2 injection for EOR/EGR will provide guidance to courts in determining standards of care for workplace safety for carbon sequestration operations.[58] Design, installation and operation safety regulations set by various federal and state agencies will influence courts in setting the standard of care, and compliance with such regulations will be an important factor in determining whether a judicial standard of care has been met if litigated in tort cases.[59]

The liabilities associated with worker health and safety, transportation and other operations such as drilling for which we have long experience are already largely addressed within existing tort law and regulatory frameworks. Contractors are willing to accept legal liability for their conduct in these areas. Accordingly, these types of liabilities are not included within the scope of the liability shield proposed by this study.

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[55] Occupational Safety & Health Administration, http://www.osha.gov/dcsp/osp/index.html (accessed August 12, 2008).

[56] Sally M. Benson, Robert Hepple, John Apps, Chin-Fu Tsang, and Marcelo Lippmann, Lessons Learned from Natural and Industrial Analogues for Storage of Carbon Dioxide in Deep Geological Formations (Lawrence Berkeley Nat'l Lab. Report LBNL-51170, 2002) *available at* http://repositories.cdlib.org/lbnl/LBNL-51170/.

[57] Occupational Safety & Health Administration, Carbon Dioxide (Revised Sept. 20, 2001), *at* http://www.osha.gov/dts/chemicalsampling/data/CH_225400.html.

[58] Research into the safety record of EOR operations suggests that adequate steps are being taken to protect worker safety. Sally M. Benson, Stanford University, personal communications, March 18, 2008. See also Gary Adams, Health and Safety Handbook for Enhanced Oil Recovery, The MITRE Corporation, August 1983 (noting that "Since CO_2 is neither toxic nor flammable, the increased hazard associated with CO_2 is minimal compared with the hazards which exist at conventional oil production sites.").

[59] See, e.g., 49 CFR 191-199, which sets safety and reporting requirements for the design, installation, operation and maintenance of interstate pipelines transporting carbon dioxide. States with jurisdiction over intrastate pipelines have either incorporated these same standards by reference or adopted similar or even more stringent provisions.

Property Laws Governing Carbon Capture and Storage

State property laws control the ownership of subsurface pore space, the rights to access and use that space, and liability concerning its use. In turn, these rights determine whose consents are necessary or desirable before proceeding with a CCS project.

At the time of this writing, Wyoming is the only state that has adopted property laws relating to the long-term storage of CO_2. In the absence of specific legislation governing property rights in relation to CCS, state property laws determine ownership of underground pore space and injected CO_2. Because different types of geologic formations are generally governed by different bodies of property law, property laws governing CCS projects differ depending upon the type of formation. Oil and gas reservoirs are typically governed by state property law regarding oil, gas and mineral rights. Saline formations are generally governed by state water laws.[60]

State Mineral Laws

For mineral-bearing formations, a majority of states follow the "American Rule" which vests legal title to the formation in the surface rights holder unless these rights are severed. Where a separate mineral rights holder exists, the mineral rights holder's interest is dominant over the surface estate as long as minerals remain on the property. Minerals are typically never completely exhausted, so the mineral rights holder will generally continue to retain an interest following the completion of active mining activities under the American Rule.[61] The "English Rule" followed by a minority of the states vests the mineral rights holder with the ownership of the mineral formation even following completion of mining activities.

State Water Laws

For saline formations, state water law controls ownership and the rights of other parties who use subsurface water. The five major rules in the United States are the absolute dominion rule, reasonable use rule, correlative rights rule, Restatement rule, and prior appropriation rule.[62] Under the absolute dominion rule, the surface interest owner owns and can use all water beneath the property without liability to others.[63] The reasonable use rule allows a landowner to use groundwater in reasonable amounts for beneficial uses on the land above the aquifer. Under the correlative rights rule, landowners may extract water from a common aquifer in proportion to their land area.[64] In California, application of the correlative rights rule also takes into account reasonableness of use based on custom, social utility, safe yield, and need.[65] Under the Restatement rule, a surface rights owner may use groundwater for any purpose or location (including off the property) in a reasonable manner. The prior appropriation rule grants water use rights to prior users (the "first in time" rule).

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[60] Mark A. de Figueiredo, Howard J. Herzog, Paul L. Joskow, Kenneth A. Oye, and David M. Reiner, Regulating Carbon Dioxide Capture and Storage, MIT Center for Energy and Environmental Policy Research Working Paper 07-003 (2006) *available at* http://tisiphone.mit.edu/repec/mee/wpaper/2007-003.pdf.

[61] Orpha A. Merrill, Note and Comments, *Oil and Gas: Substratum Storage Problems*, 7 OKLA. L. REV. 225, 227 (1954).

[62] Mark A. de Figueiredo, *Property Interests and Liability of Geologic CO_2 Storage: A Special Report to the MIT Carbon Sequestration Initiative* (Sept. 2005), *available at* http://sequestration.mit.edu/pdf/defigueiredo_property_interests.pdf.

[63] *Bristor v. Cheatham*, 255 P.2d 173, 178 (Ariz. 1953).

Tort Theories of Liability

This section focuses on tort theories of liability potentially applicable to carbon sequestration activities. These are trespass, negligence, nuisance and strict liability. Seismic activity induced by CCS or leakage of CO_2 affecting public health or damaging property are examples of the kinds of occurrences that might support a claim under one or more of these theories. In all cases, however, a plaintiff must show that the CCS activity actually caused the plaintiff harm.

Trespass

Trespass is the unauthorized entry upon land. Trespass can occur on the surface or subsurface levels.[66] The common law distinguishes between willful or intentional trespass and mistaken or inadvertent trespass.[67] Under the traditional rule of trespass, damages are not required to be proven on the theory that intent is adequate to show damages.

Although presently no trespass cases involving CCS have been litigated, cases involving subsurface trespass resulting from other underground injection activities suggest that a successful trespass claim would likely require a showing of actual damages, as would be expected in any tort case. At least one jurisdiction has required a showing of actual damages to support a claim of trespass for cases involving subsurface injections. In *Chance et al. v. BP Chemicals, Inc.*, the court held that without a showing of physical damage or interference with the use of the neighboring property, the subsurface lateral migration of injection fluid onto a neighboring property from a properly permitted deep well injection under the UIC program that was non-negligently maintained would not give rise to liability under theories of trespass. In reaching its decision, the court limited the surface owner's rights to "the right to exclude invasions of the subsurface property that actually interfere with appellants' reasonable and foreseeable use of the subsurface." Significantly, the court noted that there appears to be no cases in any jurisdiction imposing liability in the absence of actual damages for permitted, non-negligent deep-well disposal.[68]

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[64] Earl Finbar Murphy, The Recurring State Judicial Task of Choosing Rule for Groundwater Law: How Occult Still?, 66 NEB. L. REV. 120, 134 (1987).

[65] *City of Pasadena v. City of Alhambra*, 207 P.2d 17, 33 (Cal. 1949) *cert. denied*, 339 U.S. 937 (1950).

[66] Owen Anderson et al., Hemingway Oil and Gas Law and Taxation §§ 4.1 and 4.2 (4th ed. 2004).

[67] W.L. Summers, The Law of Oil and Gas § 2.7 (3rd ed. 2004).

The potential for CO_2 to migrate across property boundaries or to escape to the atmosphere could give rise to claims for trespass and damages if it can be shown that a surface or subsurface property right is infringed that causes actual damages. CO_2 injection for permanent storage that prevents a landowner from exploiting its property, such as extraction of mineral resources, could produce actual damages. Similarly, if CCS becomes commonplace and a value is placed on storage space, damages could be awarded for migration of CO_2 across property boundaries that interferes with other property owners' ability to use their underground pore space for carbon sequestration.

Other legal theories that may be employed to seek recovery where a trespass is proven include conversion, implied contract, unlawful appropriation of trade secrets,[69] assumpsit (for rental value of occupied land), and confusion of goods.[70]

Negligence

Liability for negligence arises where a plaintiff can show that a defendant owed a duty of care to the plaintiff, the defendant failed to meet the required standard of care, the negligent acts or omissions caused harm to the plaintiff (actual cause), resulting in damages, and it was reasonably foreseeable that plaintiff's breach of the duty could have caused such harm (proximate cause).[71]

In the context of CCS, virtually every aspect of a CCS project will involve a duty of care owed to one or more groups, including surface and subsurface rights owners, neighboring property rights owners, workers and other invitees onto land, and residents in the vicinity of a CCS operation. These duties will arise at every step of the CCS project, including site selection and assessment, drilling, injection, transportation, well closure, monitoring, and reporting. Standards of care for CCS projects will be shaped in part by experience in the oil and gas industry, CO_2 handling and transport, and enhanced oil and gas recovery operations.

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[68] *Chance et al. v. BP Chem., Inc.*, 77 Ohio St.3d 17, 670 N.E.2d 985 (Ohio 1996).

[69] Unlawful appropriation of trade secrets could be argued where a trespass results in disclosure of information about subsurface conditions that adversely affects the market value of property. Owen Anderson et al., Hemingway Oil and Gas Law and Taxation § 4.1(B). (4th ed. 2004). See generally *City of Northglenn v. Grynberg*, 846 P.2d 175, 183 (Colo. 1993), *cert. denied*, 510 U.S. 815 (1993) (collecting seismic information without permission could constitute misappropriation of a trade secret, but holding that information was already publicly known in particular case so was not a trade secret).

[70] Owen Anderson et al., Hemingway Oil and Gas Law and Taxation § 4.1(B)-(C). (4th ed. 2004); 15A C.J.S. Confusion of Goods § 1.

[71] *Palsgraf v. Long Island R.R. Co.*, 248 N.Y. 339, 162 N.E. 99 (N.Y. 1928).

Nuisance

Persons in possession of real property (either land owners or tenants) are entitled to the quiet enjoyment of their lands. Hazards, pollution, smells, and sounds that interfere with the quiet enjoyment of real property may bring a claim of nuisance. Normal, reasonable uses of property that may affect one's enjoyment of property will not give rise to a nuisance claim. Nor does nuisance include trespass.

There are two types of nuisance: private and public. A private nuisance is an unreasonable interference with a property owners' quiet enjoyment of land. A public nuisance is an unreasonable interference with the public's right to property, including interference with public health, safety, peace or convenience. Often, a public nuisance will also violate law, such as zoning laws or laws protecting public health and safety. A private nuisance that affects many people will often be treated as public nuisance.

Remedies for nuisance include payment of damages and injunction against the activity. In one influential case, the court allowed a cement plant that produced air pollution affecting neighboring residences to continue to pollute but to pay permanent damages reflecting the net present value of the diminution in value caused by its activities.[72]

Strict Liability

Strict liability generally applies to hazardous or inherently dangerous activities. Strict liability often applies to product liability claims and the use of explosives. Under the doctrine of strict liability, a person is liable for damages and losses caused by his or her acts and omissions regardless of whether the person acted negligently or possessed intent to cause harm. Under strict liability, the plaintiff need only prove that the tort occurred and that the defendant was responsible. A defendant's taking all possible precautions is not a valid defense to strict liability.

State Authority to Adjust Property Rights for Public Use

Under the U.S. Constitution and applicable state constitutions, each state is vested with power to adjust private property rights. Eminent domain and unitization are two legal methods that could be employed to adjust property rights to facilitate the development of CCS.

Eminent Domain

Eminent domain is "[t]he inherent power of a government entity to take privately owned property, especially land, and convert it to public use, subject to reasonable compensation for the taking."[73] In the United States, the Fifth Amendment prohibits taking of private property without "just compensation." The Fourteenth Amendment extends these Fifth Amendment protections to eminent domain actions taken by the states.[74]

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[72] *Boomer v. Atlantic Cement Co.*, 26 N.Y.2d 219, 309 N.Y.S.2d 312 (N.Y. 1970) (The court's judgment was based on the fact that the cost of closing the plant or installing pollution abatement equipment would have been far greater than the damages caused to the plaintiffs).

The power of eminent domain has been exercised on behalf of, and even delegated to, private companies where there is a public use. The public use requirement has been broadly interpreted to include virtually any aspect of the common welfare, including economic development, health or safety. In Kelo et al. v. City of New London, the Supreme Court upheld a city government's exercise of eminent domain on behalf of private developers in a condemnation action on private residences where "the city has carefully formulated a development plan that it believes will provide appreciable benefits to the community, including but not limited to, new jobs and increased tax revenue."[75]

The Natural Gas Act of 1938[76] grants private companies engaged in interstate transportation of natural gas the right to exercise federal eminent domain powers to obtain property for transportation facilities.[77] Federal court decisions later extended the Natural Gas Act's grant of eminent domain power to natural gas storage.[78] To exercise eminent domain power, a company is required to engage in good faith negotiations with property holders, and in the event negotiations fail, obtain a certificate of public convenience and necessity from the Federal Energy Regulatory Commission following a public hearing.[79]

The exercise of eminent domain under the Natural Gas Act provides precedent that could be relevant to the potential use of this doctrine in the context of CCS projects. In Columbia Gas Transmission Corporation v. An Exclusive Natural Gas Storage Easement, the Ohio Supreme Court provided valuation guidelines for subsurface natural gas storage space in an eminent domain action under the Natural Gas Act. The court held that the fair market value and just compensation for an easement could be determined by comparable sales of storage space, the rental income for the right to store gas, the value of any commercially recoverable gas and oil deposits that could not be exploited by a landowner as a result of the gas storage facility, and the diminution in value of the property as a result of the exercise of eminent domain.[80]

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[73] Black's Law Dictionary, 7th Edition, West Group, St. Paul, Minnesota, 1999. See also Eminent Domain, 26 Am.Jur.2d, 2004.

[74] *Chicago Burlington & Quincy R.R. v. Chicago*, 166 U.S. 226 (1897).

[75] *Kelo et al. v. City of New London, Conn. et al.*, 545 U.S. 469 (2005).

[76] 15 U.S.C. § 717 et seq. (2008)

[77] 15 U.S.C. §717f(h).

[78] *Columbia Gas Transmission Corp. v. An Exclusive Natural Gas Storage Easement*, 776 F.2d 125, 128 (6th Cir. 1985).

[79] 15 U.S.C. §717f(c). See also Steven D. McGrew, Note: Selected Issues in Federal Condemnations for Underground Natural Gas Storage Rights: Valuation Methods, Inverse Condemnation, and Trespass, 51 CASE WES. RES. L. REV. 131 (2000).

Unitization Laws

Field unitization is the common management, including profit and loss sharing, of oil producing properties within a formation in order to maximize the field's production and resolve competing claims for production.[81] Most oil producing states have some form of unitization law, either on a purely voluntary or a compulsory basis when a statutorily specified percentage of ownership in a field petitions for the arrangement.

The degree of consent required for mandatory unitization in different U.S. states ranges from a single owner representing any percentage to as high as 85% of the land in a field.[82] Although Texas has a voluntary unitization arrangement, the Texas Railroad Commission which regulates oil production in that state will approve unitization arrangements among field owners seeking unitization, omitting those that do not consent.[83]

Unitization has proven to be an effective method to address property rights issues in oil production areas. Unitization could be employed in the CCS context to overcome property rights and legal liability issues associated with operating a large carbon sequestration project involving many property holders.

State Efforts to Develop CCS Legislation

The Interstate Oil and Gas Compact Commission (IOGCC), which comprises 38 U.S. states, has issued a model statute and regulations for CCS, which includes property rights and liability rules.[84] It calls for state governments to take title to, and release operators from liability for, CCS reservoirs that have ceased injection for a period of 10-years or other time frame established by statute, and are certified to be reasonably expected to retain mechanical integrity and remain emplaced. The IOGCCC model law contains an eminent domain provision allowing for state and private parties to acquire property rights in order to conduct CCS activities.

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[80] *Columbia Gas Transmission Corporation v. An Exclusive Natural Gas Storage Easement*, 67 Ohio St.3d 463, 620 N.E.2d 48 (1993).

[81] A. Allen King, Pooling and Unitization of Oil and Gas Leases, 46 MICH. L. REV. 311, 313 (1948); Jacqueline Lang Weaver & David F. Asmus, Unitizing Oil and Gas Fields Around the World: A Comparative Analysis of National Laws and Private Contracts, 28 HOUS. J. INT'L. L. 3, 12 (2006).

[82] U.S. Office of Technology Assessment, Enhanced Oil Recovery Potential in the United States 24 (NTIS PB-276594, 1978), *available at* http://www.princeton.edu/nota/disk3/1978/7807/7807.pdf.

[83] Paula C. Murray & Frank B. Cross, *The Case for a Texas Compulsory Unitization Statute*, 23 ST. MARY'S L.J. 1099, 1153 (1992).

[84] Interstate Oil and Gas Compact Commission Task Force on Carbon Capture and Geologic Storage, Storage of Carbon Dioxide in Geologic Structures: A Legal and Regulatory Guide for States and Provinces (September 25, 2007) *available at* http://www.southwestcarbonpartnership.org/_resources/pdf/2008-co2-storage-legal-and-regulatory-guide-for-states-full-report.pdf.

The State of Wyoming is the first state to enact dedicated comprehensive statutes governing CO_2 injection and storage,[85] including rules for property rights.[86] The Wyoming CCS legislation integrates the state's existing SDWA UIC program.

At the time of writing, over half a dozen states are contemplating CCS legislation or rulemaking, including actions such as studies, developing CCS incentive programs, and mandating use of CCS.[87]

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[85] Carbon Capture and Sequestration Act, Ch. 30, 2008 Wyo. Sess. Laws 48 *available at* http://legisweb.state.wy.us/2008/Enroll/HB0090.pdf; WYO. STAT. ANN. §34-1-152 (2008).

[86] Ownership of Subsurface Pore Space Act, Ch. 29, 2008 Wyo. Sess. Laws 47, *available at* http://legisweb.state.wy.us/2008/Enroll/HB0089.pdf; WYO. STAT. ANN. §34-1-152 (2008).

[87] These include Idaho, Illinois, Kansas, Montana, Ohio, Oklahoma, Texas, Utah, Washington, and Wyoming. Kristin Holloway Jones, Alston & Bird, State CCS Legislative & Regulatory Developments, Alston & Bird, May 6, 2008.

Appendix C: Survey Form

REGIONAL CARBON SEQUESTRATION PARTNERSHIP: NAME OF SURVEY RESPONDENT:						
Project Description	Parties (Circle applicable)	Of the parties, which are private entities? (Circle applicable)	Has anyone requested Indemnity? (Circle applicable)	Has anyone refused to grant rights? (Circle applicable)	Please indicate if you are seeking property rights from neighboring properties? If so, describe who, why and whether there are any barriers or difficulty in obtaining necessary rights.	Please describe any difficulty experienced or anticipated to obtain government permits? (e.g., public opposition, cost, resources)
Project Name: Location: Type of Formation: Tons CO_2: Site Area: Status of project: EOR: Unitized: EIS Required?	Site Land Owner Site Subsurface Owner Site Mineral Lessee Site Water rights holder Drilling/ Injection Company	Site Land Owner Site Subsurface Owner Site Mineral Lessee Site Water rights holder Drilling/ Injection Company	Site Land Owner Site Subsurface Owner Site Mineral Lessee Site Water rights holder Drilling/ Injection Company	Site Land Owner Site Subsurface Owner Site Mineral Lessee Site Water rights holder Drilling/ Injection Company	Y/N: From who are you seeking? Adjacent Land Owner Adjacent Subsurface Owner Adjacent Site Mineral Lessee Adjacent site water rights Why seeking consents? Barriers to obtaining consents?	
Has any rights holders sought compensation for their consent?						
Please describe any other barriers you have encountered in these projects:						
Percentage Time Consumed: Non-Research (Legal/Administrative) % Research (including characterization) %						

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Spread in model climate sensitivity traced to atmospheric convective mixing

Steven C. Sherwood[1], Sandrine Bony[2] & Jean-Louis Dufresne[2]

Equilibrium climate sensitivity refers to the ultimate change in global mean temperature in response to a change in external forcing. Despite decades of research attempting to narrow uncertainties, equilibrium climate sensitivity estimates from climate models still span roughly 1.5 to 5 degrees Celsius for a doubling of atmospheric carbon dioxide concentration, precluding accurate projections of future climate. The spread arises largely from differences in the feedback from low clouds, for reasons not yet understood. Here we show that differences in the simulated strength of convective mixing between the lower and middle tropical troposphere explain about half of the variance in climate sensitivity estimated by 43 climate models. The apparent mechanism is that such mixing dehydrates the low-cloud layer at a rate that increases as the climate warms, and this rate of increase depends on the initial mixing strength, linking the mixing to cloud feedback. The mixing inferred from observations appears to be sufficiently strong to imply a climate sensitivity of more than 3 degrees for a doubling of carbon dioxide. This is significantly higher than the currently accepted lower bound of 1.5 degrees, thereby constraining model projections towards relatively severe future warming.

Ever since numerical global climate models (GCMs) were first developed in the early 1970s, they have exhibited a wide range of equilibrium climate sensitivities (roughly 1.5–4.5 °C warming per equivalent doubling of CO_2 concentration)[1] and consequently a broad range of future warming projections, with the uncertainty due mostly to the range of simulated net cloud feedback[2,3]. This feedback strength varies from roughly zero in the lowest-sensitivity models to about 1.2–1.4 $\mathrm{W\,m^{-2}\,K^{-1}}$ in the highest[4]. High clouds (above about 400 hPa or 8 km) contribute about 0.3–0.4 $\mathrm{W\,m^{-2}\,K^{-1}}$ to this predicted feedback because the temperatures at the tops of the clouds do not increase much in warmer climates, which enhances their greenhouse effect. Mid-level cloud changes also make a modest positive-feedback contribution in most models[5].

Another positive feedback in most models comes from low cloud, occurring below about 750 hPa or 3 km, mostly over oceans in the planetary boundary layer below about 2 km. Low cloud is capable of particularly strong climate feedback because of its broad coverage and because its reflection of incoming sunlight is not offset by a commensurate contribution to the greenhouse effect[6]. The change in low cloud varies greatly depending on the model, causing most of the overall spread in cloud feedbacks and climate sensitivities among GCMs[5,7]. No compelling theory of low cloud amount has yet emerged.

A number of competing mechanisms have, however, been suggested that might account for changes in either direction. On the one hand, evaporation from the oceans increases at about 2% $\mathrm{K^{-1}}$, which—all other things being equal—may increase cloud amount[8]. On the other hand, detailed simulations of non-precipitating cloudy marine boundary layers show that if the layer deepens in a warmer climate, more dry air can be drawn down towards the surface, desiccating the layer and reducing cloud amount[8,9].

The lower-tropospheric mixing mechanism

We consider that a mechanism similar to this one, which has so far been considered only for a particular cloud regime, could apply more generally to shallow upward moisture transports, such as by cumulus congestus clouds or larger-scale shallow overturning found broadly over global ocean regions. Air lifted out of the boundary layer can continue ascending, rain out most of its water vapour, and then return to a relatively low altitude—or it can exit the updraught directly at the low altitude, retaining much more of its initial vapour content. The latter process reduces the "bulk precipitation efficiency" of convection[10], allowing greater transport of moisture out of the boundary layer for a given precipitation rate. Such a process can increase the relative humidity above the boundary layer[11] and dry the boundary layer. Unlike the global hydrological cycle and the deep precipitation-forming circulations[12], however, it is not strongly constrained by atmospheric energetics[11].

We present measures of this lower-tropospheric mixing and the amount of moisture it transports, and show that mixing varies substantially among GCMs and that its moisture transport increases in warmer climates at a rate that appears to scale roughly with the initial lower-tropospheric mixing.

Mixing-induced low cloud feedback

The resulting increase in the low-level drying caused by lower-tropospheric mixing produces a mixing-induced low cloud (MILC) feedback of variable strength, which can explain why low-cloud feedback is typically positive[5] and why it is so inconsistent among models.

In a GCM, vertical mixing in the lower troposphere occurs in two ways (Extended Data Fig. 1). First, small-scale mixing of heat and water vapour within a single grid-column of the model is implied by convective and other parametrizations. Lower-tropospheric mixing and associated moisture transport would depend on transport by shallow cumulus clouds, but also on the downdrafts, local compensating subsidence and evaporation of falling rain that are assumed to accompany deeper cumulus. Second, large-scale mixing across isentropes occurs via explicitly resolved circulations. Whether this contributes to lower-tropospheric mixing will again depend on model parametrizations, but in this case, on their ability to sustain the relatively shallow heating that must accompany a shallow (lower-tropospheric) circulation. We measure these two mixing phenomena independently, starting with

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the small-scale part, and show that both phenomena progressively dry the boundary layer as climate warms.

The small-scale component of mixing

Lower-tropospheric mixing parametrized within a GCM grid cell cannot be directly diagnosed from model output (although it contributes to the convective terms in the water vapour budget; see below). We assert, however, that an atmosphere's propensity to generate such mixing can be gauged by observing the thermal structure just above the boundary layer in ascending, raining regions. As discussed above, air there is either transported directly from the boundary layer with minimal precipitation via lower-tropospheric mixing, or indirectly by ascending in deeper, raining clouds and then descending. The air would arrive cool and humid in the former case, but warmer and drier in the latter case owing to the extra condensation, allowing us to evaluate which pathway dominates by observing mean-state air properties.

To do this we use an index S, proportional to the differences $\Delta T_{700-850}$ and $\Delta R_{700-850}$ of temperature and relative humidity between 700 hPa and 850 hPa (S taken as a linear combination; see Methods Summary) averaged within a broad ascending region which roughly coincides with the region of highest Indo-Pacific ocean temperatures (the Indo-Pacific Warm Pool; Fig. 1). Of the full set of 48 models used in this study, those with a less negative $\Delta T_{700-850}$ in this region consistently show a more negative $\Delta R_{700-850}$ there (Fig. 2a), and the variations in each quantity are quite large. We interpret this as strong evidence that both quantities are dominated by variations, evidently large, in the amount of lower-tropospheric mixing in the ascent region, with higher S indicating stronger mixing.

Small-scale lower-tropospheric mixing of moisture is part of the overall source of the water vapour that is associated with the parametrized convection, M_{small}. This quantity is available from nine of the models (see Methods Summary). It always exhibits strong drying near the surface. Above about 850 hPa, it can either dry the atmosphere on average or moisten it depending on the model (Extended Data Fig. 2), reflecting the competition between drying from condensation and moistening from lower-tropospheric mixing and from evaporating precipitation falling from higher altitudes.

Although M_{small} does not reflect lower-tropospheric mixing alone, we can test whether lower-tropospheric mixing (as diagnosed from S) affects how M_{small} responds as climate warms. The available data confirm that, given a +4 K warming, convective drying of the planetary boundary layer increases by 4–17 W m^{-2} (6–30%), compared to a typical increase of 8% in global or tropical surface evaporation. The drying increase is highly correlated ($r = -0.79$) with S (Fig. 2b). Thus, convective dehydration of the planetary boundary layer outstrips the increase in surface evaporation with warming, in all models except those with the lowest S. Higher-sensitivity models also have higher S (Fig. 1), suggesting that this process drives a positive feedback on climate.

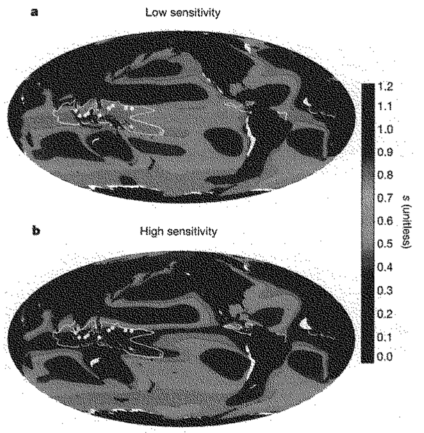

Figure 1 | Multimodel-mean local stratification parameter *s*. The index S is the mean of s within the regions outlined in white. Multimodel averages of s are shown separately for low-sensitivity (ECS < 3.0 °C) (**a**) and high-sensitivity (ECS > 3.5 °C) (**b**) models, among coupled models with known ECS. The white dots inside the S-averaging region show the locations of radiosonde stations used to help estimate S observationally. A few coastal regions that are off-scale appear white.

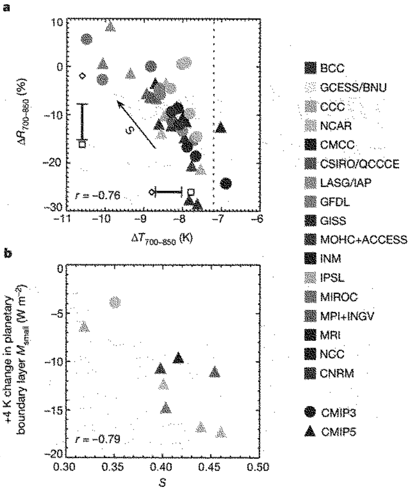

Figure 2 | Basis for the index *S* of small-scale lower-tropospheric mixing and its relationship to the warming response. **a**, $\Delta T_{700-850}$ versus $\Delta R_{700-850}$, each averaged over a tropical region of mean ascent (see Fig. 1), from all 48 coupled models. For reference, a saturated-adiabatic value of ΔT is shown by dotted line at −7.2 K, and a dry-adiabatic value (not shown) would be about −16 K. Error bars are 2σ ranges. **b**, Change in small-scale moisture source M_{small} below 850 hPa in the tropics upon +4 K ocean warming, versus S computed from the control run, in eight atmosphere models and one CMIP3 model. Symbol colour indicates modelling centre or centre where atmosphere model was originally developed and symbol shape indicates model generation.

The large-scale component of mixing

We next turn to the large-scale lower-tropospheric mixing, which we associate with shallow ascent or flows of air upward through the top of the boundary layer that diverge horizontally before reaching the upper troposphere. Although air ascending on large scales over warm tropical oceans typically passes through nearly the whole troposphere, over cooler oceans its ascent often wanes with altitude, showing that this type of mixing indeed occurs in the Earth's atmosphere (Fig. 3). The associated mid-level outflows are well documented for the central

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and eastern Pacific and Atlantic Intertropical Convergence Zone and some monsoon circulations[13,14]. Although these are indeed the regions where shallow ascent is steadiest, and hence clearest in monthly-mean data (Fig. 3), in daily reanalysis data, shallow ascent is equally strong outside the tropics owing largely to contributions from extratropical storms. We also note that although we focus here on regions of ascending air, that is because the ascending branches are where the circulations are easiest to measure; they must, however, descend elsewhere, exerting a net transport of water vapour that is upward and towards the convective regions.

Figure 3 compares the observations with two example models. Neither model shows as much shallow ascent (red colour) as the observation-based estimates, but the Institut Pierre Simon Laplace (IPSL)-CM5A model comes closer. Although convective treatment in the newer IPSL-CM5B model is more detailed and produces better results in important respects[15], here it is seen to produce strong deep ascent of air (white spots) where it is weaker and shallower in observations (red zones), showing that improvement in some aspects of a simulation does not automatically improve others.

We quantify the large-scale lower-tropospheric mixing more thoroughly by calculating the ratio D of shallow to deep overturning (see Methods Summary) in a broad region encompassing most of the persistent shallow ascent (see Fig. 3). This index D varies by a factor of four across 43 GCMs (see below). Interestingly, however, D and S are uncorrelated ($r = 0.01$), confirming that the two scales of mixing are controlled by different aspects of model design.

The effective source of moisture $M_{\mathrm{LT,\,large}}$ due to this shallow overturning (that is, large-scale, lower-tropospheric convection) and its change upon climate warming, can be directly calculated from model wind and humidity fields. We approximate $M_{\mathrm{LT,\,large}}$ using monthly-mean data from the ten available atmospheric models (see Methods Summary). $M_{\mathrm{LT,\,large}}$ isolates only shallow mixing, whereas M_{small} includes the effects of all parameterized convection; yet despite this, the profiles $M_{\mathrm{LT,\,large}}$ (Fig. 4) resemble those of M_{small}, with strong drying in the boundary layer and weak moistening above. Not unexpectedly, these effects are greater in the high-D models than in the low-D ones.

Crucially, the low-level drying also increases faster upon +4 K warming in the high-D models (by about 30%, or $1.5\,\mathrm{W\,m^{-2}\,K^{-1}}$ when expressed as a latent heat flux) than in the low-D models (25%, or $0.9\,\mathrm{W\,m^{-2}\,K^{-1}}$). Thus, the response of $M_{\mathrm{LT,\,large}}$ grows with D as M_{small} grew with S; the relationship for D is not as strong ($r = 0.46$ for land + ocean, $r = 0.25$ for ocean only), partly because the spread of D happens to be somewhat narrow among the available atmosphere models, but is still significant at 95% confidence.

Climate sensitivity

We now apply the indices S and D to the 43 GCMs for which an equilibrium climate sensitivity (ECS) is available. Each index independently explains about 25% of the variance in ECS (Fig. 5a, b).

Because the ranges of D and S are similar (each 0.3–0.4), as are (approximately) those of their drying responses upon warming (see below), we form an overall lower-tropospheric mixing index (the LTMI) by simply adding the two: LTMI = $S + D$. This LTMI explains about 50% of the variance in total system feedback ($r = 0.70$) and ECS ($r = 0.68$) (Fig. 5c). Thus, although our measure of lower-tropospheric mixing does not explain all of the variations among GCMs, it does explain a significant portion of the model spread.

This explanatory power derives primarily from low cloud feedbacks. The correlation between LTMI and the +4 K change in shortwave cloud radiative effect in the atmosphere models, which spans a range of $1.8\,\mathrm{W\,m^{-2}\,K^{-1}}$ in the tropics, is 0.65 in the tropics and 0.57 in subsidence regions (equivalent values estimated from a subset of the coupled models providing the needed output are 0.25 and 0.47

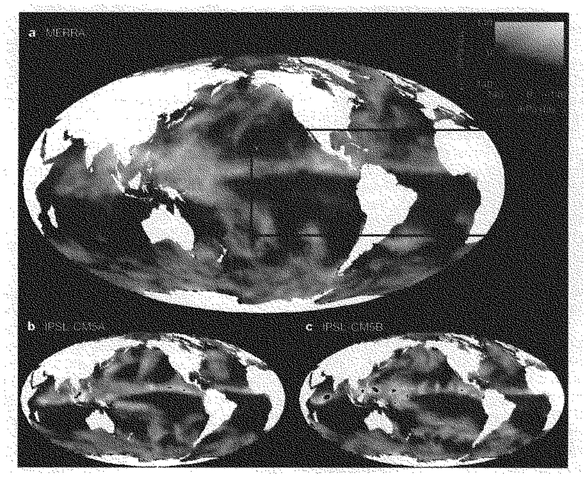

Figure 3 | The structure of monthly-mean tropospheric ascent reveals large-scale lower-tropospheric mixing in observations and models. Upward pressure velocity ω in one month (September) from the MERRA reanalysis (**a**), the IPSL-CM5A model (**b**) and the IPSL-CM5B model (**c**) with values at 850 hPa shown in red and those at 500 hPa shown in green plus blue. Bright red implies ascent that is weighted toward the lower troposphere with mid-tropospheric divergence (see colour scale), white implies deep ascent, and dark colours imply descent. In **a**, black lines outline the region in which the index D of large-scale lower-tropospheric mixing is computed. The Pacific and Atlantic Intertropical Convergence Zone regions are consistently red in the reanalyses and models, whereas isolated red patches in other areas tend to vary with time.

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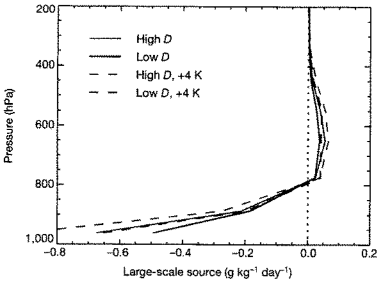

Figure 4 | Estimated water vapour source $M_{\mathrm{LT,large}}$ due to large-scale lower-tropospheric mixing and its response to warming. See Methods for calculation details. Data are from ten atmosphere models, averaged from 30° S to 30° N over oceans, with the average of the four models having the largest D shown in magenta and the average of the four models with the smallest D shown in blue. Dashes show results in +4 K climate. Changes at +4 K are nearly identical whether or not land areas are included.

respectively). These correlations suggest that the predictive skill of LTMI arises from both subsidence and other regions; further work is needed to better assess this. Cloud amount reduces more in high-LTMI models both at low and mid-levels (Extended Data Fig. 3), although the greater net radiative impact of low cloud makes its effect dominant[16]. Previously reported water vapour and lapse-rate feedbacks[17] are, in contrast, not correlated with the LTMI.

Is the imputed lower-tropospheric mixing impact on low clouds strong enough to explain the approximately 1.5 W m^{-2} K^{-1} spread of cloud feedbacks seen in GCMs?[4] One recent study[18] imposed increased surface latent heat fluxes in a large region typified by shallow clouds, finding an increase in cloud-related net cooling of about 1 W m^{-2} for a 2–3 W m^{-2} increase in the surface flux, other things held fixed. An even larger sensitivity, nearly 1:1, has been reported in a different model for advective changes in moisture input[19]. If a similar but opposite cloud response occurred for moisture removal by lower-tropospheric mixing, then to explain the feedback spread, the boundary-layer drying responses would need to span a range across models of about 3 W m^{-2} per K of surface warming. This roughly matches the contribution to the spread from M_{small} alone (Fig. 2b). The additional drying response from $M_{\mathrm{LT,large}}$ was about 0.6 W m^{-2} K^{-1} greater in the high-D models (mean D of 0.34) than in the low-D ones (mean 0.24), which, if rescaled by the full spread of D in the full GCM ensemble, implies a further source of spread in drying response of about 2 W m^{-2} K^{-1}. We conclude that, even if not all low clouds are as sensitive as the ones examined in the cited studies, the lower-tropospheric mixing response is strong enough to account for the cloud feedback spread and its typically positive sign[5].

Why does moisture transport increase so strongly with warming? The magnitude of these increases, typically 5%–7% per K of surface warming, is roughly what would be expected if the circulations remained similar against a Clausius–Clapeyron increase in moisture gradients[20], as indeed it does, at least for the large-scale part[21] (Extended Data Fig. 4). Further study is needed to understand why this is so, and to examine in greater detail how clouds respond to changing moisture transports; changes in low cloud amount may for example help the atmosphere restore imbalances in boundary layer moist enthalpy such as those caused by lower-tropospheric mixing[19]. Because LTMI ignores any information on clouds, it is likely that additional measures of cloud characteristics[22] could explain some of the variations in low-cloud feedback not yet explained here.

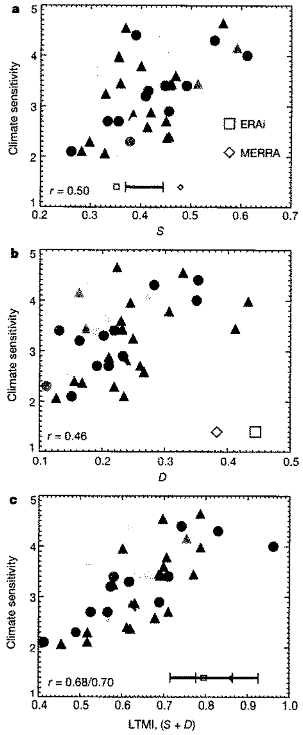

Figure 5 | Relation of lower-tropospheric mixing indices to ECS. ECS versus S (**a**), D (**b**) and LTMI = $S + D$ (**c**) from the 43 coupled models with known ECS. Linear correlation coefficients r are given in each panel ($r = 0.70$ in **c** is the correlation to the total system feedback). Error bars shown near panel axes indicate 2σ ranges of the direct radiosonde estimate (**a**) and the S value from radiosondes added to the D value from each of the two reanalyses (**c**). ERAi and MERRA are the two monthly reanalysis products.

We end by considering observational estimates of S and D (see Fig. 5). These show an S near the middle of the GCM range, but a D close to the top end, as hinted already by Fig. 3. D may not be well constrained because ω must be inferred from observational reanalyses, although available horizontal wind observations support the existence of strong mid-level outflows[13], and the result is consistent across both reanalyses examined. The reanalysis estimates of S are less consistent but this quantity can be fairly well constrained by radiosonde observations.

Taking the available observations at face value implies a most likely climate sensitivity of about 4 °C, with a lower limit of about 3 °C. Indeed, all 15 of the GCMs with ECS below 3.0 °C have an LTMI below the bottom of the observational range. Further work may be needed to better constrain these indices, and to test whether their relationship to ECS is robust to design factors common to all models. For example, this should be tested in global cloud-resolving models.

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The possibility can never be ruled out that feedbacks could exist in nature that are missing from all models, which would change the climate sensitivity from that suggested by our result. Nonetheless, on the basis of the available data, the new understanding presented here pushes the likely long-term global warming towards the upper end of model ranges.

Discussion

Although a few previous studies have already noted that higher-sensitivity models simulate certain cloud-relevant phenomena better[23–25], ours is the first to demonstrate a causal physical mechanism, or to show consistent predictive skill across so many models, or to point to processes connecting low-cloud regions to the deep tropics. The MILC mechanism is surprisingly straightforward. Lower-tropospheric mixing dries the boundary layer, and the drying rate increases by 5–7% K^{-1} in warmer climates owing to stronger vertical water vapour gradients. The moisture source from surface evaporation increases at only about 2% K^{-1}. Thus as climate warms, any drying by lower-tropospheric mixing becomes larger relative to the rest of the hydrological cycle, tending to dry the boundary layer. How important this is depends on how important the diagnosed lower-tropospheric mixing was in the base state of the atmosphere. Lower-tropospheric mixing is unrealistically weak in models that have low climate sensitivity.

Climate-sensitivity-related differences in lower-tropospheric mixing, both at small (Fig. 1) and large scales (Fig. 3), are most detectable in regions of tropical deep or mixed-level convection and mean upward motion. This does not mean, however, that the greater low-level drying in a warmer climate or the spread of drying among models will be limited to these regions.

Large-scale lower-tropospheric mixing carries water vapour not only upward but also horizontally away from subsidence regions; because both directions of transport intensify in a warmer atmosphere[20], subsidence regions should bear the brunt of the overall boundary-layer drying. Moreover, shallow ascent is equally strong (though more transient) in mid-latitude storm tracks and in the tropics, suggesting that MILC feedback may be just as important outside the tropics as within them.

As for small-scale lower-tropospheric mixing, even though there are reasons to measure it in ascending regions (see Methods), its impact upon warming is much more widespread and differs significantly among models in subsiding regions (Extended Data Fig. 5). We hypothesise that this is because models with more small-scale lower-tropospheric mixing in ascending regions also have more in descending regions, although we cannot confirm this directly. Overall, the behaviour is consistent with published results showing that subsiding regions contribute strongly to the spread of cloud feedbacks in models, with storm tracks and tropical convective regions also playing a part[16,26,27].

Lower-tropospheric mixing behaviour appears to result from a competition between shallow and deep convection in situations where either could occur. Such situations persist in many tropical regions, notably the Intertropical Convergence Zone. Understanding and properly representing this competition in climate models is undoubtedly necessary for more accurate future climate projections.

Although tested here on models used over the past decade or so, we presume that this mechanism has been a leading source of spread in sensitivity since the dawn of climate modelling. Finally to identify an atmospheric process that drives variations in climate sensitivity offers an unprecedented opportunity to focus research and model development in ways that should lead to more reliable climate change assessments.

METHODS SUMMARY

Data for computing S and D come from control runs of 48 models: 18 from the Coupled Model Intercomparison Project version 3 (CMIP3)[28] and 30 from CMIP5 (ref. 29) (see Extended Data Tables 1 and 2). ECS was reported for all but one CMIP3 model by the Intergovernmental Panel on Climate Change[28]. For CMIP5 we employ effective climate sensitivities calculated from abrupt $4 \times CO_2$ experiments, available for 26 models, following a standard regression procedure[30,31].

Data for M_{small} and $M_{\mathrm{LT,large}}$ come from ten CMIP5 atmosphere models providing 'amip' (specified ocean surface temperature) control and +4 K ocean warming runs. Eight of these models provided M_{small}; we also included data from the Parallel Climate Model (CMIP3).

Observational estimates come from radiosondes and two monthly reanalysis products (ERAi and MERRA). Reanalyses are produced from a model constrained to the fullest extent possible by a variety of observations[32,33].

We calculate S within a region where convective effects are a leading term in thermodynamic budgets, defined by the upper quartile of the annual-mean mid-tropospheric ascent rate where it is upward, $-\omega_{500}$ (ω the pressure velocity). We define $S \equiv (\Delta R_{700\text{-}850}/100\% - \Delta T_{700\text{-}850}/9\,\mathrm{K})/2$, which normalizes $\Delta R_{700\text{-}850}$ to 100% humidity, $\Delta T_{700\text{-}850}$ to the approximately 9-K range between dry and saturated adiabatic values, and averages these two pieces of information with equal weight to reduce noise from other factors.

To calculate $M_{\mathrm{LT,large}}$ we compute ω_1 (the average of ω at 850 hPa and 700 hPa) and ω_2 (the average of ω at 600 hPa, 500 hPa and 400 hPa). $\Delta = \omega_2 - \omega_1$ measures the local horizontal outflow in the lower troposphere above the boundary layer. Moisture is transported upward and outward wherever $\Delta > 0$ and $\omega_1 < 0$. We restrict measurement to tropical ocean regions from 160° W to 30° E (see Fig. 3). The moisture supplied to the environment is estimated as $M_{\mathrm{LT,large}} = -\langle q\mathrm{d}\omega/\mathrm{d}pH(\Delta)H(-\omega_1)\rangle$, where p is the pressure, q is the specific humidity, $\langle\ldots\rangle$ indicates the mean over the restricted region, and H is the step function. Finally, $D \equiv \langle \Delta H(\Delta)H(-\omega_1)\rangle / \langle -\omega_2 H(-\omega_2)\rangle$.

Online Content Any additional Methods, Extended Data display items and Source Data are available in the online version of the paper; references unique to these sections appear only in the online paper.

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Author Contributions S.C.S. led the study and the writing of the paper, and did the calculations of LTMI and related diagnostics. S.B. computed cloud radiative effect and assisted in interpreting results and writing the paper. J.-L.D. computed ECS and assisted in interpreting results and writing the paper.

Author Information Reprints and permissions information is available at www.nature.com/reprints. The authors declare no competing financial interests. Readers are welcome to comment on the online version of the paper. Correspondence and requests for materials should be addressed to S.C.S. (s.sherwood@unsw.edu.au).

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METHODS

Data for computing S and D come from 48 models: 18 from the CMIP3 (Coupled Model Intercomparison Project version 3)[28], the first two years of each "picntrl" run, and 30 models from the CMIP5 (ref. 29), the first two years of each "1pctCO2" run. Two years of data is sufficient to specify S and D to within 0.02 or better of their long-term values. CMIP3 data were obtained from the Australian National Computational Infrastructure node, and CMIP5 data including the 'amip' and 'amip+4K' runs were obtained on 14 September 2012 and 22 October 2012 from the IPSL Ciclad repository. ECS values for CMIP3 were reported for all but one model by the Intergovernmental Panel on Climate Change[28]. For CMIP5 we employ effective climate sensitivities calculated from abrupt $4 \times CO_2$ experiments, available for 26 of the 30 CMIP5 models, following a standard regression procedure[30,31].

Data for M_{small} and $M_{\mathrm{LT,large}}$ come from ten CMIP5 atmosphere models providing 'amip' (specified ocean surface temperature) control and +4 K ocean warming experiments. A key advantage of this experiment setup is that interannual ocean variability is the same in the control and warming runs, and changes in the sea surface temperature pattern—which could complicate interpretation, especially for circulation changes—are avoided. Data are from 1989–98, except for IPSL-CM5A, in which some of these years were corrupted and alternative years were used. Results from individual years were similar to those for the ten-year averages. Eight of these models provided M_{small}; we also included data from the PCM CMIP3 1%-per-year-to-quadrupling experiment, with changes rescaled to the +4 K equivalent (actual change 3.3 K). PCM M_{small} data come from ten years near the beginning and ten years near the end of the 1%-per-year-to-quadrupling experiment, obtained from the National Center for Atmospheric Research node of the Earth System Grid.

The shortwave cloud radiative effect is obtained by differencing the all-sky and clear-sky top-of-atmosphere shortwave fluxes for each model run. To calculate cloud feedback we first composite the sensitivity of the shortwave cloud radiative effect to sea surface temperature in dynamical regimes defined by vertical-mean vertical velocity, and then we compute the sum (weighted by the probability distribution function of ω) over regimes (or only subsidence regimes defined by $\omega > 0$)[7]. For coupled models, the warming-induced change is obtained from abrupt CO_2-quadrupling experiments, after removing the instantaneous change associated with rapid adjustment to higher CO_2 estimated from the first 12 months after quadrupling. Only one realization is used per model. For atmosphere-only models it is simply the difference between the +4 K and the control simulations.

Observational estimates come from radiosondes and from two monthly reanalysis products (ERAi and MERRA), years 2009–10. The reanalyses are produced from a model constrained to the full extent possible by a variety of observations[32,33]. MERRA reanalysis data from 1 September 2009 were used to compare D inside and outside the tropics, but monthly data were used otherwise. Radiosonde data were obtained from the Integrated Global Radiosonde Archive and subjected to simple quality-control checks for outliers. The ten stations sited in the relevant region and meeting the criteria described by a previous study[34] were used, and the mean taken over the 2 years. The radiosonde network sampling bias, as determined from station-sampled reanalysis output, was relatively small compared to the overall reanalysis biases.

We calculate S in ascending regions, where convective effects are a leading term in thermodynamic budgets; in subsidence regions humidity is sensitive to irrelevant non-local factors and even to numerical resolution[35], perhaps explaining why it is less informative for our purposes. The calculation region is defined by the upper quartile of the annual-mean mid-tropospheric ascent rate in ascending regions, $-\omega_{500}$ (where ω is the pressure velocity). We define $S \equiv (\Delta R_{700\text{-}850}/100\% - \Delta T_{700\text{-}850}/9\,\mathrm{K})/2$, which normalizes $\Delta R_{700\text{-}850}$ to 100% humidity and $\Delta T_{700\text{-}850}$ to the approximately 9 K range between the dry and saturated adiabatic values, and then averages these two pieces of information with equal weight. Such averaging should reduce the noise from other factors that influence one quantity or the other. Varying the weighting of the two terms does not strongly affect results.

To calculate $M_{\mathrm{LT,large}}$, we first compute ω_1 (the average ω at 850 hPa and 700 hPa) and ω_2 (the average ω at 600 hPa, 500 hPa and 400 hPa). The difference $\Delta = \omega_2 - \omega_1$ then measures the local horizontal outflow in the lower troposphere above the boundary layer. Moisture is transported upward and outward at this level wherever $\Delta > 0$ and $\omega_1 < 0$. We restrict measurement to tropical ocean regions from 160° W to 30° E (see Fig. 3). The moisture supplied to the environment is then estimated as $M_{\mathrm{LT,large}} = -\langle q\mathrm{d}\omega/\mathrm{d}pH(\Delta)H(-\omega_1)\rangle$, where q is the specific humidity, $\langle\ldots\rangle$ indicates the mean over the restricted calculation region, and H is the step function. The index D is computed as $D \equiv \langle \Delta H(\Delta)H(-\omega_1)\rangle / \langle -\omega_2 H(-\omega_2)\rangle$.

Values of D and S are similar over ten years of data or one year, and are similar whether individual months or long-term means for each month of the year are used. These indices capture over 25% of the ECS variance even if computed from only a single month of data from each model. Thus, long records are unnecessary for deducing the strength of lower-tropospheric mixing.

The reason for restricting calculation of D to the cooler tropical longitudes is that a few climate models erroneously place much of the shallow ascent over warm oceans, where it does not seem to contribute as much to low-cloud feedback. In observations, and in most models, the restriction has little effect because most of the shallow ascent persistent enough to appear in monthly-mean data is already located in the specified region. We speculate that the location of the ascent matters because the associated shallow descent is more relevant if it occurs over, or upstream of, regions of radiatively important low cloud.

Both lower-tropospheric mixing indices retain statistically significant correlations with ECS for all alterations to their definitions that we tried. Specifically, the correlation of S with ECS ($r_{S\text{-ECS}}$) is similar with ω_{500} percentiles of 0.25 or 0.5, but drops with looser thresholds, which begin to pick up parts of the resolved lower-tropospheric mixing region. Tighter thresholds reduce the spread in S between models, reducing $r_{S\text{-ECS}}$. The correlation $r_{D\text{-ECS}}$ is somewhat weaker (as low as 0.3) if the longitudinal restriction for D is removed, or if other definitions of ω_1 and ω_2 are used.

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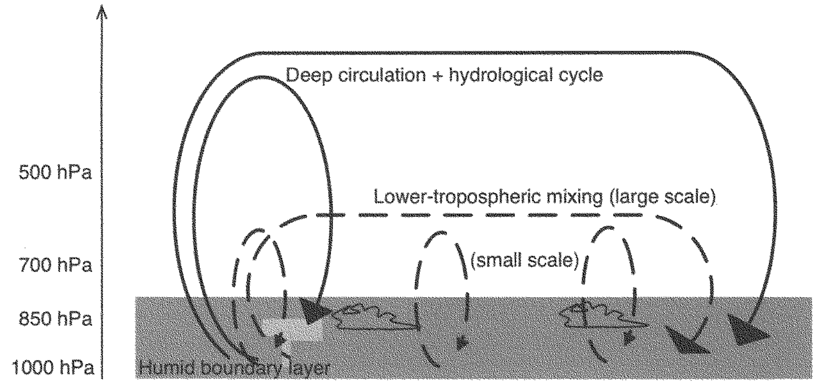
Deep circulation + hydrological cycle
Lower-tropospheric mixing (large scale)
(small scale)
500 hPa
700 hPa
850 hPa
1000 hPa
Humid boundary layer

Extended Data Figure 1 | Illustration of atmospheric overturning circulations. Deep overturning strongly coupled to the hydrological cycle and atmospheric energy budget is shown by solid lines; lower-tropospheric mixing is shown by dashed lines. The MILC feedback results from the increasing relative role of lower-tropospheric mixing in exporting humidity from the boundary layer as the climate warms, thus depleting the layer of water vapour needed to sustain low cloud cover.

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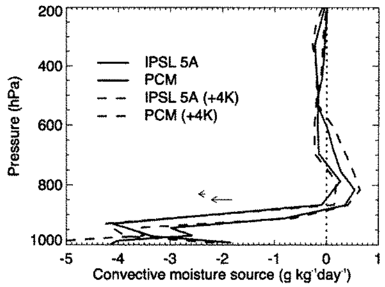

Extended Data Figure 2 | Small-scale moisture source M_{small}. Vertical profile averaged over all tropical oceans, for two selected climate models (see legend) with very different warming responses, in present-day (solid) and +4 K (dashed) climates.

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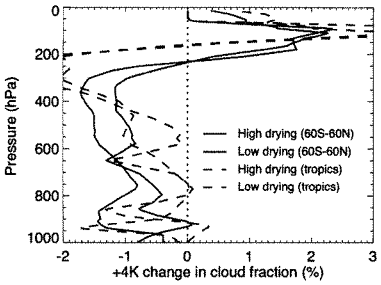

Extended Data Figure 3 | Response of cloud fraction to warming. Profile of average change in model cloud fractional cover at +4 K in the four atmosphere models with largest (magenta) and smallest (blue) estimated +4 K increases in planetary-boundary-layer drying, averaged from 30° S to 30° N (dashed) or 60° S to 60° N (solid). The drying estimate is obtained by adding the explicitly computed change in $M_{\mathrm{LT,large}}$ to the change in M_{sm} estimated from S via the relationship shown in Fig. 2a. The typical mean cloud fraction below 850 hPa is about 10% to 20%, and the changes shown are absolute changes in this fraction, so are of the order of 10% of the initial cloud cover.

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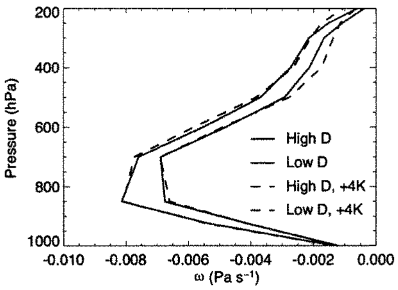

Extended Data Figure 4 | Response of large-scale lower-tropospheric mixing to warming. Profiles of mean vertical velocity in regions of shallow ascent, in control and +4 K climates. The similarity of dashed and solid lines indicates that mass overturning associated with these regions is roughly the same in the warmer simulations, on average.

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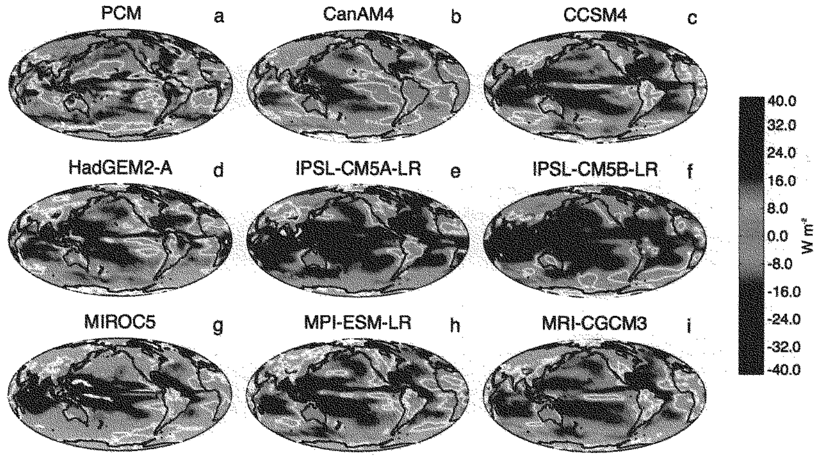

Extended Data Figure 5 | Response of small-scale, low-level drying to warming. Change in convective moisture source M_{small} below 850 hPa upon a +4 K warming in eight atmosphere models and one CMIP3 coupled model; units are W m^{-2}, with negative values indicating stronger drying near the surface. Zero contours are shown in white (a few off-scale regions also appear white). The models used for calculating M_{large} are the eight shown here plus two for which M_{small} data were unavailable: CNRM-CM5 and FGOALS-g2.

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Extended Data Table 1 | List of CMIP5 coupled models used

Model	Centre	Forcing (W m^{-2})	Total feedback (W m$^{-2}K^{-1}$)	ECS (K)
ACCESS1-0	ACCESS	3.01	-0.79	3.79
ACCESS1-3	ACCESS	2.96	-0.86	3.45
BCC-CSM1-1	BCC	3.35	-1.16	2.88
BNU-ESM	GCESS/BNU	3.78	-0.92	4.11
CanESM2	CCC	3.85	-1.05	3.68
CCSM4	NCAR	3.70	-1.27	2.92
CESM1-BGC	NCAR	—	—	—
CESM1-CAM5	NCAR	—	—	—
CMCC-CM	CMCC	—	—	—
CNRM-CM5	CNRM	3.71	-1.14	3.25
CSIRO-Mk3-6-0	CSIRO/QCCCE	2.63	-0.66	3.99
FGOALS-g2	LASG/IAP	2.89	-0.84	3.45
FGOALS-s2	LASG/IAP	3.84	-0.92	4.16
GFDL-CM3	GFDL	3.00	-0.76	3.96
GFDL-ESM2G	GFDL	3.11	-1.31	2.38
GFDL-ESM2M	GFDL	3.41	-1.41	2.41
GISS-E2-H	GISS	3.83	-1.66	2.30
GISS-E2-R	GISS	3.77	-1.79	2.11
HadGEM2-ES	MOHC	2.95	-0.65	4.55
INMCM4	INM	2.98	-1.44	2.07
IPSL-CM5A-LR	IPSL	3.12	-0.76	4.10
IPSL-CM5B-LR	IPSL	2.66	-1.03	2.59
MIROC5	MIROC	4.16	-1.54	2.71
MIROC-ESM	MIROC	4.27	-0.92	4.65
MPI-ESM-LR	MPI	4.15	-1.15	3.60
MPI-ESM-MR	MPI	4.11	-1.20	3.44
MPI-ESM-P	MPI	4.35	-1.27	3.42
MRI-CGCM3	MRI	3.26	-1.26	2.59
NorESM1-ME	NCC	—	—	—
NorESM1-M	NCC	3.21	-1.13	2.83

Centre acronyms used to identify them in scatter plots are also shown. The derived forcing, total feedback, and equilibrium climate sensitivities are given for models with abrupt 4 × CO_2 simulations.

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Extended Data Table 2 | List of CMIP3 coupled models used

Model	Centre	ECS (K)
CCCMA-CGCM3 1	CCC	3.4
CCCMA-CGCM3 1 T63	CCC	3.4
GFDL-CM2-0	GFDL	2.9
GFDL-CM2-1	GFDL	3.4
GISS-MODEL-E-H	GISS	2.7
GISS-MODEL-E-R	GISS	2.7
IAP-FGOALS1-0-G	IAP	2.3
INGV-ECHAM4	INGV	—
INMCM3-0	INM	2.1
IPSL-CM4	IPSL	4.4
MIROC3-2-HIRES	MIROC	4.3
MIROC3-2-MEDRES	MIROC	4.0
MPI-ECHAM5	MPI	3.4
MRI-CGCM2-3-2A	MRI	3.2
NCAR-CCSM3-0	NCAR	2.7
NCAR-PCM1	NCAR	2.1
UKMO-HadCM3	MOHC	3.3
UKMO-HadGEM1	MOHC	4.4

Centre acronyms used to identify them in scatter plots are also shown, as are feedback values given by ref. 28.

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POLITICO *Pro*

Challenge to EPA power plant rule surprised administration

By ERICA MARTINSON (/REPORTERS/?ID=193) | 1/9/14 3:57 PM EST

EPA and the White House were caught off guard when House Republicans turned to a 2005 energy law to try to undercut a controversial climate regulation, according to newly released documents.

House Republicans pulled off a November surprise for EPA and the administration when they whipped out a provision of the 2005 Energy Policy Act (http://1.usa.gov/1fMVMmr) that they say challenges the legality of the EPA's proposal to require new coal-fired power plants capture at least 30 percent of their carbon emissions.

The issue didn't come up during interagency review of the rule at the White House Office of Management and Budget, and the Republicans' moves sent the EPA staff scrambling to figure out a legal response, according to emails released by the administration this week in the proposed rule's docket.

On Nov. 15, Energy and Commerce Committee Chairman Fred Upton (R-Mich.) and Reps. Joe Barton (R-Texas), Ed Whitfield (R-Ky.) and Steve Scalise (R-La.) wrote a letter to EPA (http://1.usa.gov/IaBiry) asking the agency to withdraw its proposed power plant emissions rule, saying the three carbon capture projects EPA cited as evidence of the technology's viability were out of bounds.

The 2005 law says that no technology or level of emission reduction made by a facility that received assistance under the law can be considered to be "adequately demonstrated" under section 7411 of the Clean Air Act (http://bit.ly/15mGcfV), which governs new source standards, they argue. The three projects EPA had cited all received funding from the Energy Department's Clean Coal Power Initiative.

An OMB official sought out EPA input on the issue on Nov. 19, after the news broke, according to the emails.

"Can we discuss this at your earliest convenience?" policy analyst Nathan Frey asked three EPA officials in one email (https://www.politicopro.com/f/?f=22927&inb).

EPA, meanwhile, was scrambling to figure out a response.

"The letter just got down to my desk today, so we are still working through the issues with [the office of general counsel] /management and will follow up with you once we have a more complete assessment. However, our initial assessment is that we can address the concerns that have been raised, but we're just working through the best way to do that," Robert Wayland, a strategy leader in the air office responded.

"As soon as we have some resolution internally, we'll be glad to have a discussion with you and others," he told Frey.

Frey quickly responded, "Thanks Bob. I look forward to the discussion as soon as folks there are able," and he offered to "chat if easier."

That was the end of publicly available discussion on the issue, with no further written correspondence evident, although they may have followed up via phone. Frey also noted in the November email that "lots of folks are confused as to why" the rule had not yet been published in the Federal Register.

But EPA hasn't offered any real answer yet.

At the time, EPA spokeswoman Alisha Johnson said the agency would review the letter and respond, although no answer has emerged yet.

"We still have yet to receive a response to our letter questioning the legality, but EPA appears to be moving full speed ahead with this proposed rule despite the concerns we raised that it is in clear violation of the Energy Policy Act of 2005," Whitfield, the chairman of the Energy and Power Subcommittee, said late Wednesday.

"We will continue our vigorous oversight of this rulemaking, which has been fraught with irregularities, and we continue to believe that EPA is acting far beyond the scope of its legal authority at the detriment of the American public," he added.

EPA spokesman David Bloomgren said Thursday that the agency is still working on its response, and that no new language regarding the 2005 energy act was added in the rule that was published in the Federal Register (http://1.usa.gov/1lNMkA8) on Wednesday.

Whether EPA's proposal showed that carbon capture is technologically and economically viable was a key part of interagency review at OMB, other documents in the docket show. Obama administration officials outside of EPA repeatedly asked EPA to back its assertion that carbon capture and sequestration is "adequately demonstrated" — with varying degrees of support for the rule — during interagency review of the draft rule in August, the documents show.

EPA, in response, told administration officials that it would work to make sure the proposed rule that was released Sept. 20 would show that CCS is ready for prime time — and not just based on literature reviews and several unfinished projects. The agency also said it felt the rule should offer incentive for new research into CCS, and not result in future research being moved to the sidelines.

Greens have offered some defense of EPA's approach.

"The 2005 Energy Act says that EPA cannot determine that a technology or emission rate is adequately demonstrated for [Clean Air Act] purposes 'solely' because of use of the technology at one or more projects that have received some government funding," NRDC's Director of Climate Programs David Hawkins said in a November email.

EPA's decision was not just based on those projects that received government funding, but also on long-term experience with capturing, transporting and injecting carbon dioxide underground and numerous Energy Department studies, he said.

Koch brothers donated big to ALEC, Heartland Institute

According to financial disclosures, the Kochs donated $24 million to conservative foundations in 2011

JILLIAN RAYFIELD

26 98 g+1 2

TOPICS: HEARTLAND INSTITUTE, KOCH BROTHERS, DAVID KOCH, ALEC, CLIMATE CHANGE, CONSERVATIVES, POLITICS NEWS

David Koch (Credit: AP/Mark Lennihan)

Tax filings obtained by the Center For Public Integrity show that the billionaire brothers Charles and David Koch donated a combined $24 million to various conser Like ions and think tanks in 2011, through the four foundations that they run.

From CPI:

> A $4.5 million grant to the George Mason University Foundation makes up nearly 15 percent of the university foundation's revenue for 2011. The school is the largest recipient of Koch foundation money since 1985, and it houses several free-market and libertarian research centers including the Institute for Humane Studies, which received $3.7 million from the Koch foundations.

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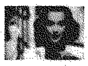

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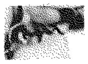

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The D.C.-based American Legislative Exchange Council received $150,000 to help finance its activities, including meetings where corporate representatives draft model legislation with state legislators. The Koch brothers have decades-long connections with ALEC, which gave the brothers the Adam Smith Free Enterprise Award in 1994.

Among the other groups the Koch brothers donated to were the Heartland Institute, the climate change-skeptical think tank, which received $25,000; the Federalist Society, which got $260,000; and the Ayn Rand Institute, which took in $100,000.

Jillian Rayfield is an Assistant News Editor for Salon, focusing on politics. Follow her on Twitter at @jillrayfield or email her at jrayfield@salon.com.

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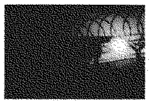

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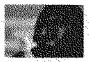

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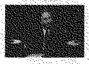

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Federal Climate Change Expenditures Report to Congress

August 2013

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FISCAL YEAR 2014 REPORT TO CONGRESS ON FEDERAL CLIMATE CHANGE EXPENDITURES

1. INTRODUCTION

"We can't have an energy strategy for the last century that traps us in the past. We need an energy strategy for the future – an all-of-the-above strategy for the 21st century that develops every source of American-made energy."

—President Barack Obama, March 15, 2012

"We will continue to lead by the power of our example, because that's what the United States of America has always done. I am convinced this is the fight America can, and will, lead in the 21st century. And I'm convinced this is a fight that America must lead. But it will require all of us to do our part. We'll need scientists to design new fuels, and we'll need farmers to grow new fuels. We'll need engineers to devise new technologies, and we'll need businesses to make and sell those technologies. We'll need workers to operate assembly lines that hum with high-tech, zero-carbon components, but we'll also need builders to hammer into place the foundations for a new clean energy era."

—President Barack Obama, June 25, 2013

The following is an accounting of Federal funding for climate change programs and activities, both domestic and international, included in the fiscal year (FY) 2014 President's Budget. This report is provided in response to Title IV, Division E, Section 425, of P.L. 112-74, the Consolidated Appropriations Act of 2012 continued under P.L. 113-6, Consolidated and Further Continuing Appropriations Act, 2013:

> *Not later than 120 days after the date on which the President's fiscal year 2013 budget request is submitted to Congress, the President shall submit a comprehensive report to the Committee on Appropriations of the House of Representatives and the Committee on Appropriations of the Senate describing in detail all Federal agency funding, domestic and international, for climate change programs, projects and activities in fiscal year 2011, including an accounting of funding by agency with each agency identifying climate change programs, projects and activities and associated costs by line item as presented in the President's Budget Appendix, and including citations and linkages where practicable to each strategic plan that is driving funding within each climate change program, project and activity listed in the report.*

1.1 BACKGROUND

The U.S. Government's portfolio of climate change programs and cross-cutting initiatives focuses on advancing our understanding of climate change and its impact on our communities; advancing the development and introduction of energy-efficient, renewable, and other low- or non-emitting technologies; improving standards for measuring and registering emissions reductions and supporting preparedness and resilience to climate change impacts. Many elements of the Administration's climate change portfolio are designed to provide incentives for greenhouse gas (GHG) emissions reductions domestically to support community-based preparedness and resilience efforts, to ensure that Federal operations and facilities continue to protect and serve citizens in a changing climate, and to promote international initiatives focused on concrete actions toward reducing greenhouse gas emission and enhance climate preparedness globally. The Obama Administration has set a U.S. GHG emissions reduction target in the range of 17 percent below 2005 levels by 2020 and approximately 83 percent below 2005 levels by 2050.

Climate and Global Change Research and Education. Through the U.S. Global Change Research Program (USGCRP), U.S. scientists are conducting world-class research on climate and global change. The USGCRP coordinates scientific research across 13 Federal departments and agencies with the mission of "build[ing] a knowledge base that informs human responses to climate and global change through coordinated and integrated Federal programs of research, education, communication, and decision support."[1]

Reducing Emissions through Clean Energy Investments and Standards. The Administration is pursuing a wide range of initiatives that reduce greenhouse gas emissions through clean energy technologies and policies. The Administration has made the largest clean energy investment in American history and these investments have allowed the U.S. to double America's renewable power generation since 2008.

International Leadership. Under President Obama's leadership, the United States has engaged the international community to promote sustainable economic growth and to meet the climate change challenge through a number of important venues including: international climate negotiations in Copenhagen (2009), Cancun (2010), and Durban (2011); the Major Economies Forum, the Clean Energy Ministerial, the Climate and Clean Air Coalition, and the Asia-Pacific Economic Cooperation (APEC) Summit.

Climate Change Adaptation. At the request of President Obama, an interagency Climate Change Adaptation Task Force has crafted recommendations for how Federal agency policies and programs can better prepare the United States to address the risks associated with a changing climate. Federal agencies have released their first-ever climate change adaptation plans to help ensure smart decisions that protect our investments and safeguard the health and security of our communities, economies, natural resources, and infrastructure from the impacts of severe weather, rising sea levels, and other changing climate conditions. The Task Force has also helped develop the National Fish Wildlife and Plants Climate Adaptation Strategy to guide ecosystem adaptation and resiliency efforts. [2]

---

[1] http://www.globalchange.gov/about

[2] www.wildlifeadaptationstrategy.gov

The budget information presented in this report reflects the Administration's commitment to address climate change while preserving a strong American economy. The President's 2014 Budget proposes over $21.4 billion for climate change activities. This amount is $1.2 billion, or 5 percent, lower than the 2013 enacted level for climate change programs, activities, and related tax policies.

1.2 REPORT OUTLINE

The President's 2014 Budget supports a wide range of climate change-related research, development, and deployment programs, voluntary partnerships, and international aid efforts. This report presents the expenditures associated with this portfolio of activities in five main categories – science, technology, international assistance, tax provisions, and adaptation efforts associated with natural resource adaptation – as described below:

- **Climate Change Science**. This category encompasses the U.S. Global Change Research Program (USGCRP).

- **Clean Energy Technology**. Clean Energy Technology incorporates a variety of technology research, development, and deployment activities – including voluntary partnerships and grant programs – that support reductions in greenhouse gas emissions and reliance on fossil fuels. This category comprises work on clean energy systems and sources such as geothermal, solar, wind, biomass, nuclear, and emerging sources such as water power. It also includes programs or technologies or practices that help improve energy efficiency or reduce energy consumption, such as building efficiency, more effective transmission or distribution of electricity, and vehicle technologies that improve engine efficiency or fuel economy.

- **International Assistance**. This category describes elements of a "whole of government" approach to mobilize a wide range of resources and make use of bilateral and multilateral assistance tools. The core budget includes resources for a coordinated set of programs designed to ensure an effective balance across the three pillars of the global climate effort: Adaptation, Clean Energy, and Sustainable Landscapes.

- **Energy Tax Provisions**. This category includes tax incentives for investments in certain energy technologies, and energy payments that can be used in lieu of certain tax credits. These incentives promote deployment of energy efficient or alternative energy technologies, which may help reduce greenhouse gas emissions.

- **Climate Change Adaptation, Preparedness, and Resilience.** There are numerous efforts across the Federal Government for preparing and building resilience to the impacts of climate change on various critical sectors, institutions, and agency mission responsibilities. This concept is also known as "adaptation." Led by the Interagency Climate Change Adaptation Task Force, and using risk management principles, agencies are working to ensure they can continue to perform their missions in the face of climate change. Successful preparedness efforts often involve integrating climate change considerations into existing agency programs, projects, and activities rather than establishing separate and distinct programs. This creates a challenge when attempting to fully account for all adaptation resources. While the Administration continues to develop methodologies to account for a broader suite of adaptation programs across all critical sectors, an interim category, described further in section 6, summarizes certain activities at the Department of the Interior designed to promote preparedness and resilience. The activities at the Department of the Interior reflect interagency efforts to address key adaptation challenges that cut across the jurisdictions and missions of individual Federal agencies, and affect fresh water, oceans and coasts, and fish, wildlife and plants.

The following sections provide further detail in each of these five areas.

Table 1

Summary of Federal Climate Change Expenditures

(budget authority in millions of dollars)

Summary of Climate Expenditures[1]	FY 2012 Enacted Budget Authority	FY 2013 Enacted Budget Authority	FY 2013 Current Budget Authority[8]	FY 2014 Proposed Budget Authority	Change in Budget Authority 2013-2014
US Global Change Research Program (USGCRP)	**2,506**	**2,509**	**2,463**	**2,658**	**+149**
Clean Energy Technologies	**6,121**	**6,088**	**5,783**	**7,933**	**+1,845**
International Assistance [2,7]	**958**	**851**	**797**	**893**	**+42**
Natural Resources Adaptation	**88**	**95**	**95**	**110**	**+15**
Energy Tax Provisions That May Reduce Greenhouse Gases [3,4]	**5,052**	**4,999**	**4,999**	**5,129**	**+130**
Energy Payments in Lieu of Tax Provisions [5,6]	**5,080**	**8,080**	**8,080**	**4,710**	**-3,370**
Adjustments for programs included in multiple categories	*-24*	*-24*	*-22*	*-23*	---
Total [1,7]	**19,781**	**22,598**	**22,195**	**21,408**	**-1,189**

Footnotes:

[1] Budget Authority provided in millions of dollars and are current as of June 21, 2013. Discrepancies with other published documents may result from rounding and improved estimates.

[2] International Assistance includes congressionally appropriated assistance by core agencies (i.e. Department of State, Department of Treasury, US Agency for International Development) as well as complementary agencies (e.g., Environmental Protection Agency), but does not include indirect climate assistance nor development finance and export credit agencies.

[3] Tax incentives related to climate change included in this report were projected at about $23.5 billion over five years (2014-2018). These estimates do not reflect the extension of several temporary tax provisions by the American Taxpayer Relief Act of 2012.

[4] Tax expenditures are estimates of the revenue losses due to a tax preference. While not exactly equivalent to budget authority, tax expenditure estimates are included for completeness.

[5] Firms can take an energy payment in lieu of certain tax credits. The payments are considered outlays and are direct substitutes for the energy tax provisions. Estimates have been included in all columns for completeness.

[6] Energy payments in lieu of tax credits included in this report are currently projected at $9.1 billion over five years (2014-2018).

[7] The International Assistance total contains funds that are also counted in the USGCRP and Clean Energy Technology totals. Table total line excludes this double-count.

[8] Current Budget Authority for FY 2013 throughout this document reflects the amount the program has available for the year calculated as the appropriated amount (as reported in the FY 2013 Enacted column) minus the reductions pursuant to the Budget Control Act of 2011 (P.L. 112-25) sequestration order issued on March 1, 2013, and accounting for any known and applicable reprogrammings, transfers, or other related adjustments. Estimates are current as of June 21, 2013 and are subject to change.

2. CLIMATE CHANGE SCIENCE

The U.S. Global Change Research Program (USGCRP) was mandated by Congress in the Global Change Research Act of 1990 (P.L. 101-606) to improve understanding of uncertainties in climate science, including the cumulative effects on the environment of human activities and natural processes, develop science-based resources to support policymaking and resource management, and communicate findings broadly among scientific and stakeholder communities. Thirteen departments and agencies participate in the USGCRP. The Office of Science and Technology Policy (OSTP) and the Office of Management and Budget (OMB) work closely with the USGCRP to align the research priorities and funding plans with the Administration's priorities and agency plans. The program recently issued a new strategic plan (see description and link below).

The 2014 Budget proposes $2.7 billion for the USGCRP to support the goals set forth in the program's current strategic plan. These activities can be grouped under the following areas: improve our knowledge of Earth's past and present climate variability and change; improve our understanding of natural and human forces of climate change; improve our capability to model and predict future conditions and impacts; assess the Nation's vulnerability to current and anticipated impacts of climate change; and improve the Nation's ability to respond to climate change by providing climate information and decision support tools that are useful to policymakers and the general public. Reports and general information about the USGCRP are available on the program's website, www.globalchange.gov.

2.1 SELECTED AGENCY HIGHLIGHTS OF THE USGCRP IN THE 2014 BUDGET

- **Understand and Accurately Project Climate Change and its Impacts.** The U.S. Global Change Research Program (USGCRP) integrates Federal research and solutions for climate and global change. The new strategic plan will guide interagency investments in the Budget, including support for a National Climate Assessment of the current science and impacts of climate change. The Budget provides nearly $2.7 billion for USGCRP programs, an increase of $147 million (6 percent) above the FY 2013 enacted level.

  - The Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) is a leading sponsor of oceanic and atmospheric research and is one of the key sponsors of climate science capabilities in the Federal government. The 2014 Budget allocates $371 million for the Department of Commerce's USGCRP efforts, predominantly from NOAA; this represents an increase of $55 million or 17 percent over the FY 2013 enacted level.

  - The National Aeronautics and Space Administration's (NASA) budget includes a sustained investment in climate science, with $1.5 billion proposed for FY 2014. NASA's Earth Science program conducts first-of-a-kind demonstration flights of sensors in air and space in an effort to foster scientific understanding of the Earth system and to improve the ability to forecast climate change and natural disasters. The 2014 Budget supports several research satellites in development, an initiative to monitor changes in polar ice sheets, enhancements to climate models, and NASA contributions to the USGCRP's National Climate Assessment. NASA will continue to develop a replacement to the Orbiting Carbon Observatory (OCO).

- The National Science Foundation (NSF) provides funding for academic basic research across the entire spectrum of the sciences, engineering, and the social sciences. NSF USGCRP support totals $326 million in the 2014 Budget.

- The Department of Energy (DOE) conducts research on climate modeling and predictability that also involves advancing climate and earth system models with improved resolution and uncertainty quantification; DOE also supports long-term atmospheric and terrestrial research experiments. The 2014 Budget allocates $220 million coordinated through USGCRP, with a $7 million increase over FY 2013 dedicated to major field experiments at Arctic, tropics, and oceanic sites. DOE also partners with NSF to support the Community Earth System Model.

- The 2014 Budget provides $72 million for USGCRP programs in the Department of the Interior, an increase of $14 million or 24 percent over the 2013 funding level. Interior's lead science agency, the U.S. Geological Survey (USGS), funds several programs in coordination with other USGCRP agencies to understand the impacts of climate change on natural resources, including the National Climate Change and Wildlife Science Center, which supports a network of Climate Science Centers (CSCs). The CSC supports development of actionable science linked to resource management decisions on climate adaptation.

2.2 LINKAGES TO STRATEGIC PLANS

Interagency Strategic Plans.

- USGCRP 2012-2021 Strategic Plan. This ten-year interagency strategic plan is built around four strategic goals: Advance Science, Inform Decisions, Conduct Sustained Assessments, and Communicate and Educate. In addition to these four goals, the plan emphasizes the importance of national and international partnerships that leverage Federal investments and provide for the widest use of program results. The plan builds on the program's strengths in integrated observations, modeling, and information services for science that serves societal needs. http://downloads.globalchange.gov/strategic-plan/2012/usgcrp-strategic-plan-2012.pdf

- Our Changing Planet. Since 1989 the Global Change Research Program has submitted an annual report to Congress summarizing recent achievements, near term plans, and progress in implementing long term goals. *Our Changing Planet* also provides an overview of recent and near-term expenditures and of requested funding. http://library.globalchange.gov/products/annualreports

Individual Agency Strategic Plans. Excerpts from each participating Agency's strategic plans are provided below along with a weblink to each respective strategic plan.

- Department of Agriculture. Climate change is a central consideration in USDA's strategic planning. Strategic Goal 2 of USDA's Strategic Plan is titled *Ensure our National forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources.* USDA also developed a Climate Change Science Plan which presents an overview of the critical questions facing the Department's agencies as they relate to climate change and offers a framework for assessing priorities to ensure consistency with USDA's role in the USGCRP. The objectives of the Climate Change Science Plan include:

  - Restoring and conserving the Nation's forests, farms, ranches, and grasslands.
  - Leading efforts to mitigate and adapt to climate change.
  - Protecting and enhancing America's water resources.
  - Reducing risk from catastrophic wildfire and restore fire to its appropriate place on the landscape.
  - Supporting ecological restoration of our Nation's forests and grasslands and providing research to support improved forest management.
  - http://www.usda.gov/oce/climate_change/science_plan2010/USDA_CCSPlan_120810.pdf

- Department of Commerce. Under its broad goals of generating and communicating new, cutting-edge scientific understanding and promoting economically-sound environmental stewardship and science, the Department of Commerce's Strategic Plan highlights several objectives that will accomplish the following:

  - Advance scientific knowledge and understanding of the Earth's systems, its changing climate, and associated impacts; enhance weather, water, and climate reporting and forecasting; integrate assessments of current and future climate that identify potential impacts; support mitigation and adaptation efforts through sustained, reliable, and timely climate services; and inform the public so that it understands its vulnerabilities to a changing climate and makes informed decisions.
  - http://www.osec.doc.gov/bmi/budget/DOC_Strategic_Plan_022311.pdf

- Department of Energy. DOE's Strategic Plan includes Goal 2: *Maintain a vibrant U.S. effort in science and engineering as a cornerstone of our economic prosperity with clear leadership in strategic areas*; these areas include climate science. The Strategic Plan describes DOE's climate science objective to support *"basic and policy-relevant research underpinning a predictive, systems-level understanding of climate."* To achieve this goal, DOE will:

  - Support fundamental scientific research on climate predictability for improved future projections at the regional spatial scale and with time scales extending from sub-decadal to centennial as part of the U.S. Global Change Research Program and in coordination with the international science community.
  - Provide long-term support to major field research facilities, involving a combination of experimental and modeling activities that focus on atmospheric clouds and aerosols, and terrestrial ecosystems; many of the DOE investments leverage decades of field experience involving sophisticated observational and analytical expertise that has been deployed to sites extending from the Artic to the tropics.
  - Provide long-term support to the comparison, analysis, and diagnosis of all climate models worldwide, in order to enhance US competitiveness in the science of climate predictability.
  - http://energy.gov/sites/prod/files/2011_DOE_Strategic_Plan_.pdf

- Department of Health and Human Services, National Institutes of Health. The FY 2012- 2017 Strategic Plan for the National Institute of Environmental Health Sciences has as its Strategic Goal 5: *Identify and respond to emerging environmental threats to human health, on both a local and global scale*. To achieve this goal NIEHS will:
    - Focus on research needs to help inform policy response in public health situations in which lack of knowledge hampers policymaking, e.g., to improve understanding of the health effects that result from exposures related to climate change.
    - http://www.niehs.nih.gov/about/strategicplan/strategicplan2012_508.pdf

- Department of the Interior. DOI's FY 2011-2016 Strategic Plan contains a strategy to assess and forecast climate change and its effects with its Strategic Goal 2: *Provide Science for Sustainable Resource Use, Protection, and Adaptive Management* and Mission Area 4: *Provide a Scientific Foundation for Decision Making.* This strategy notes that successful adaptation to climate change will depend on access to a variety of options for effective management responses, and describes USGS efforts to:

    - Develop, implement, and test adaptive strategies, reduce risk, and increase the potential for ecological systems to be self-sustaining, resilient, and adaptable to environmental changes.
    - Implement partner-driven science to improve understanding of past and present land use change, develop relevant climate and land use forecasts, and identify lands, resources, and communities that are most vulnerable to adverse impacts of change from the local to global scales.
    - http://www.doi.gov/pfm/upload/DOI_StrategicPlan_FY11-16.pdf

- Department of Transportation. DOT's FY 2012-2016 Strategic Plan includes the Strategic Goal *Advance Environmentally Sustainable Policies and Investments that Reduce Carbon and Other Harmful Emissions from Transportation Sources*. Included in DOT's strategies to achieve this goal are the following:

    - Work through DOT's virtual Center for Climate Change to coordinate climate-related activities, research, and products with the climate experts throughout the Department.
    - Advance aviation climate research to understand the impacts of high-altitude aircraft emissions.
    - Provide technical assistance and incentives to States and Metropolitan Planning Organizations on strategies that reduce GHG emissions.
    - http://www.dot.gov/sites/dot.dev/files/docs/990_355_DOT_StrategicPlan_508lowres.pdf

- Environmental Protection Agency. EPA's FY 2011-2015 Strategic Plan identifies climate change science objectives. Potential impacts of climate change may include increased smog in many regions making it difficult to maintain clean air standards. Climate change may also affect water quality as large volumes of water can overload storm and waste water systems. The Agency's Strategic Plan addresses these challenges in its air and water quality goals.

    - Within EPA's Strategic Goal 1: *Taking action on climate change and improving air quality,* the Strategic Plan identifies an applied research effort to investigate the

  - influence of climate change on clean air, as well as the impacts of emissions from low-carbon fuels in transportation.
  - To achieve EPA's Strategic Goal 2: *Protecting America's water*, EPA will begin to identify actions to respond and adapt to the current and potential impacts of climate change on aquatic resources, including impacts associated with warming temperatures, changes in rainfall amount and intensity, and sea level rise.
  - http://www.epa.gov/planandbudget/strategicplan.html

- National Aeronautics and Space Administration. The 2011 NASA Strategic Plan states as its second Strategic Goal: *Expand scientific understanding of the Earth and the universe in which we live,* and as its Outcome (2.1): *Advance Earth system science to meet the challenges of climate and environmental change.* Within this strategic goal NASA's plan describes several objectives related to climate change science, including:

  - Improve understanding of and improve the predictive capability for changes in the ozone layer, climate forcing, and air quality associated with changes in atmospheric composition.
  - Enable improved predictive capability for weather and extreme weather events.
  - Quantify, understand, and predict changes in Earth's ecosystems and biogeochemical cycles, including the global carbon cycle, land cover, and biodiversity.
  - Quantify the key reservoirs and fluxes in the global water cycle and assess water cycle change and water quality.
  - Improve understanding of the roles of the ocean, atmosphere, land and ice in the climate system and improve predictive capability for its future evolution.
  - Characterize the dynamics of Earth's surface and interior and form the scientific basis for the assessment and mitigation of natural hazards and response to rare and extreme events.
  - Enable the broad use of Earth system science observations and results in decision-making activities for societal benefits.
  - http://www.nasa.gov/pdf/516579main_NASA2011StrategicPlan.pdf

- National Science Foundation. NSF's Strategic Plan FY 2011-2016 contains the strategic goal *Innovate for Society* addressing societal needs through research and education, and highlighting the role that new knowledge and creativity play in economic prosperity and society's general welfare. NSF has set Performance Goal (I-1) to *Make investments that lead to results and resources that are useful to society*, and includes a target to:

  - Support research that underpins long-term solutions to societal challenges such as climate change.
  - http://www.nsf.gov/news/strategicplan/nsfstrategicplan_2011_2016.pdf

- Smithsonian Institution. SI's FY 2012-2015 Strategic Plan describes its research-related strategic goal to *Advance and synthesize knowledge that contributes to the survival of at-risk ecosystems and species*. The Strategic Plan states an objective to understand how certain environmental stressors including climate change affect the survival of species and the functioning of ecosystems, and includes the following strategies:

  - Enhance the Smithsonian's platforms for long-term research on biodiversity and ecosystems, particularly the Smithsonian Institution Global Earth Observatories (SIGEO).
  - Marshal the Smithsonian's critical mass of biologists and paleontologists, in partnership with experts in other disciplines, to develop understanding of species and ecosystems and find innovative approaches to the complex meta-problems of biodiversity loss, ecosystem degradation, and climate change.
  - http://www.si.edu/content/pdf/about/si_strategic_plan_2010-2015.pdf

- U.S. Agency for International Development. In the USAID Policy Framework 2011-2015, a core objective is to reduce climate change impacts and promote low emissions growth. This includes the following research effort:

  - Finance up to six regional Earth observation hubs to provide over 30 developing countries with better climate change and forecasting data, enabling them to make better decisions in a wide range of areas likely to be affected by climate change.
  - http://transition.usaid.gov/policy/USAID_PolicyFramework.PDF

Table 2

U.S. Global Change Research Program

Details by Agency/Account

(Budget authority in millions of dollars)[1]

U.S. Global Change Research Program (USGCRP) [1]	**FY 2012 Enacted Budget Authority**	**FY 2013 Enacted Budget Authority**	**FY 2013 Current Budget Authority**[2]	**FY 2014 Proposed Budget Authority**	**Proposed Change in Budget Authority 2013-2014**
Department of Agriculture					
Agricultural Research Service	36	36	38	52	+16
National Institute of Food and Agriculture	50	40	40	43	+3
Economic Research Service	2	2	2	2	---
Forest Service – Forest and Rangeland Research	26	25	25	28	+3
National Agricultural Statistics Service	1	1	1	1	---
Natural Resources Conservation Services	1	1	1	1	---
Subtotal – USDA[3]	**116**	**104**	**106**	**126**	**+22**
Department of Commerce					
National Oceanic and Atmospheric Administration – Operations, Research, and Facilities	245	247	233	307	+60
National Oceanic and Atmospheric Administration – Procurement, Acquisition, and Construction	69	64	64	59	-5
National Institute of Standards and Technology (NIST)	5	5	5	5	---
Subtotal – DOC[3]	**319**	**316**	**302**	**371**	**+55**
Department of Energy					
Science – Biological & Environmental Research	**211**	**213**	**209**	**220**	+7
Department of Health and Human Services					
Centers for Disease Control and Prevention	6	7	7	7	---
National Institutes of Health	8	8	8	8	---
Subtotal – HHS[3]	**14**	**15**	**14**	**15**	**---**
Department of the Interior					
U.S. Geological Survey – Surveys, Investigations, and Research	**59**	**58**	**55**	**72**	**+14**

U.S. Global Change Research Program (USGCRP)[1]	**FY 2012 Enacted Budget Authority**	**FY 2013 Enacted Budget Authority**	**FY 2013 Current Budget Authority**[2]	**FY 2014 Proposed Budget Authority**	**Proposed Change in Budget Authority 2013-2014**
Department of Transportation					
Federal Highway Administration – Federal-Aid Highways[4]	0	0	0	0	---
Federal Aviation Administration – Research, Engineering, and Development	1	1	1	1	---
Federal Transit Administration - Research and University Research Centers[5]	0	0	0	0	---
Subtotal – DOT[3]	**1**	**1**	**1**	**1**	---
Environmental Protection Agency					
Science and Technology	**18**	**19**	**17**	**20**	**+1**
National Aeronautics and Space Administration					
Science	**1,427**	**1,447**	**1,435**	**1,499**	**+52**
National Science Foundation					
Research and Related Activities	**333**	**328**	**316**	**326**	**-2**
Smithsonian Institution					
Salaries and Expenses	**8**	**8**	**8**	**8**	---
U.S. Agency for International Development					
Development Assistance- non-add[6]	*11*	*11*	*11*	*14*	*+3*
Department of State					
Other- non-add[7]	*3*	*3*	*3*	*3*	---
Total[3]	**2,506**	**2,509**	**2,463**	**2,658**	**+149**

Footnotes:

[1] All data supersede numbers released with the 2014 Budget and are current as of June 21, 2013. Budget authority provided in millions of dollars. Any discrepancies are the result of rounding and improved estimates.

[2] Current Budget Authority for FY 2013 throughout this document reflects the amount the program has available for the year calculated as the appropriated amount (as reported in the FY 2013 Enacted column) minus the reductions pursuant to the Budget Control Act of 2011 (P.L. 112-25) sequestration order issued on March 1, 2013, and accounting for any known and applicable reprogrammings, transfers, or other related adjustments. Estimates are current as of June 21, 2013 and are subject to change.

[3] Agency subtotals and table total may not add due to rounding.

[4] The FY 2012 through FY 2014 funding for Federal Highway Administration – Federal Highway Administration – Federal-Aid Highways was less than $500,000.

[5] Federal Transit Administration – Research and University Research Centers is FTA's support for DOT's Center for Climate Change. The FY 2012 through FY 2014 funding amounts for this program are less than $500,000.

[6] USAID funding supports USGCRP and the Climate Change International Assistance effort. In the past, some USAID funding was counted under both categories. These efforts do not add to the USGCRP total.

[7] These efforts do not add to the USGCRP total.

3. CLEAN ENERGY TECHNOLOGIES

Clean Energy Technologies help to reduce, avoid, or sequester greenhouse gas emissions. These programs comprise research, development, and deployment efforts, including a variety of voluntary partnership and grant activities. The activities have the effect of stimulating the development and use of certain energy technologies, including renewable, low-carbon fossil, and nuclear technologies as well as energy efficient technologies, products, and process improvements.

Building on the Administration's progress to make the U.S. the global leader in the clean energy race and protect the environment for generations to come, the 2014 Budget will support American leadership in clean energy. Moving toward a clean energy economy will improve the air we breathe and the water we drink and enhance our energy security by reducing dependence on oil. Clean energy will play a crucial role in slowing global climate change and meeting the President's goals of cutting greenhouse gas emissions in the range of 17 percent below 2005 levels by 2020, and 83 percent by 2050. Just as important, ensuring that the Nation leads the world in the clean energy economy is an economic imperative.

The 2014 Budget proposes approximately $7.9 billion for Clean Energy Technologies. Table 3 provides a breakdown by agency of Clean Energy Technology funding.

Descriptions of some select activities are included below.

3.1 SELECTED AGENCY HIGHLIGHTS OF CLEAN ENERGY TECHNOLOGIES

- **Increased Investment in DOE Climate Change Technology activities.** The Budget proposes $6.2 billion for clean energy technology programs at the Department of Energy, 44 percent more than the 2013 enacted level. The Department's funding supports a wide range of important research, development, and deployment activities on key technologies such as solar, wind, nuclear, and carbon capture and storage. Highlights include:
    - $2.8 billion for the Office of Energy Efficiency and Renewable Energy (EERE) to accelerate research and development, to build on ongoing successes, and to further reduce the costs and increase the use of critical clean energy technologies. Within EERE, the Budget invests $957 million to increase the affordability and convenience of advanced vehicles and domestic renewable fuels and $615 million in innovative projects to make clean, renewable power, such as solar energy and off-shore wind, more easily integrated into the electric grid and as affordable as electricity from conventional sources, without subsidies. It also more than doubles funding to $885 million for energy efficiency and advanced manufacturing activities to help reduce energy use and costs in commercial and residential buildings, in the industrial and business sectors, and in Federal buildings and fleets.
    - $379 million for the Advanced Research Projects Agency - Energy (ARPA-E) to support transformational research in clean energy in areas such as solar energy, energy storage, carbon capture and storage, and advanced biofuels.

3.2 LINKAGES TO STRATEGIC PLANS

Interagency Strategic Plans.

- Blueprint for a Secure Energy Future. In March 2011, the Obama Administration released the *Blueprint for a Secure Energy Future* which outlines the comprehensive national energy policy pursued by the Administration. The *Blueprint* describes strategies across the Federal Government aimed to develop and secure America's energy supplies, provide consumers with choices to reduce costs and save energy and innovate to a clean energy future. http://www.whitehouse.gov/sites/default/files/blueprint_secure_energy_future.pdf

- Secure Energy Future: Progress Report. In March 2012 accomplishments and achievements that underscore the Administration's commitment to promoting clean energy technologies were described in the *Secure Energy Future: One Year Progress Report.* This report highlights efforts to increase energy independence, set historic fuel economy standards, improve energy efficiency, expand renewable fuel generation, develop advanced alternative fuels and support cutting-edge research. http://www.whitehouse.gov/sites/default/files/email-files/the_blueprint_for_a_secure_energy_future_oneyear_progress_report.pdf

Individual Agency Strategic Plans. Excerpts from each participating Agency's strategic plans are provided below along with a weblink to each respective strategic plan.

- Department of Agriculture. USDA's Strategic Plan for 2010-2015 includes the objective *Lead efforts to mitigate and adapt to climate change* (Strategic Goal 2, Objective 2.2). The plan also includes an objective, *Enhance rural prosperity,* by facilitating sustainable renewable energy development, promoting energy efficiency, and curbing the effects of climate change. (Strategic Goal 1, Objective 1.1). These objectives includes numerous efforts and strategies including:

    - Providing assistance to farmers, ranchers, and forest landowners to implement conservation, nutrient management, and animal management practices that reduce emissions and sequester carbon.
    - Planting and maintaining vegetative cover on marginal farmland and land that has been impacted by fire.
    - Providing assistance in the form of payments, grants, loans and loan guarantees for clean and renewable energy projects and energy efficiency improvements.
    - http://www.ocfo.usda.gov/usdasp/sp2010/sp2010.pdf

- Department of Commerce. The Commerce FY 2011-2016 Strategic Plan includes Objective 5: *Provide the measurement tools and standards to strengthen manufacturing, enabling innovation, and enhancing efficiency*, Objective 6: *Promote and support the advancement of green and blue technologies and industries*, and Objective 16: *Support climate adaptation and mitigation.* Contributing to this objective are the following:

    - Focusing on programs at National Institute of Standards and Technology (NIST) that will develop the measurements, standards, and common framework that are required to promote sustainable operations and improve energy efficiency in both the construction and manufacturing sectors.

  - Commerce: (http://www.osec.doc.gov/bmi/budget/DOC_Strategic_Plan_022311.pdf)
  - NIST: (http://www.nist.gov/director/upload/nist-master-3-year-plan-fy2012-fy2014.pdf)

- Department of Defense. As one of the Government's largest consumers of energy, the Department of Defense is committed to supporting the Administration's efforts in Clean Energy. DOD's Operational Energy Strategy outlines three principles for a stronger force: 1) *Reduce the demand for energy in military operations;* 2) *Expand and secure the supply of energy to military operations;* 3) *Build energy security into the future force.* As part of the effort to act on these principles, DOD's Operational Energy Strategy describes goals to:

  - Reduce energy demand, the most immediate operational energy priority for the Department, by investing in new technologies and equipment.
  - Expand supply options, both for near-term tactical benefits and long-term operational energy security.
  - Take energy into account in order to make more informed decisions about the choices and tradeoffs in equipping and employing forces.
  - http://energy.defense.gov/OES_report_to_congress.pdf

- Department of Energy. DOE's 2011 Strategic Plan lays a framework for utilizing the DOE's capabilities to drive solutions across energy, environmental, climate, and security challenges. It demonstrates strong linkages between clean energy and progress on environmental issues, such as climate change. Shifting to a clean energy economy directly supports the Administration's climate change objective to reduce energy-related greenhouse gas emissions. In particular, Goal 1 of the Strategy: *Catalyze the timely, material, and efficient transformation of the nation's energy system and secure U.S. leadership in clean energy technologies* focuses on activities that support transforming the nation's energy system and building a sustainable and competitive clean energy economy. Targeted outcomes that support this goal include:

  - DOE and the U.S. Department of Housing and Urban Development working together to enable the cost-effective energy retrofits of a total of 1.1 million housing.
  - Double renewable energy generation from wind, solar, and geothermal energy sources.
  - Encourage industry to translate our R&D outputs to market through new contractual vehicles that lower transaction costs and address commercialization barriers.
  - http://energy.gov/sites/prod/files/2011_DOE_Strategic_Plan_.pdf

- Department of Transportation. DOT's FY 2012-2016 Strategic Plan includes a goal to *Advance environmentally sustainable policies and investments that reduce carbon and other harmful emissions from transportation sources.* Contributing to this goal are strategies to:

  - Reduce carbon emissions, improve energy efficiency, and reduce dependence on oil, including establishment of fuel economy standards for cars and trucks and research into alternative aircraft fuels.

  - Reduce transportation-related air, water and noise pollution and impacts on ecosystems, including expanding opportunities for shifting freight from less fuel-efficient modes to more fuel-efficient modes.
  - Increase the use of environmentally sustainable practices in the transportation sector, including more environmentally sound construction and operational practices.
  - Reduce pollution from DOT owned or controlled transportation services and facilities, including implementing net-zero-energy building requirements for all new buildings entering the design process in 2020 and thereafter.
  - Promote the deployment of technologies—such as hydrogen fuel cell and diesel-electric hybrid buses—that reduce the energy consumption and greenhouse gas emissions of transit systems.
  - http://www.dot.gov/sites/dot.dev/files/docs/990_355_DOT_StrategicPlan_508lowres.pdf

- Environmental Protection Agency. The first goal in EPA's FY 2011-2015 Strategic Plan, *Taking action on climate change and improving air quality,* includes efforts to:

  - Develop a national system for reporting GHG emissions.
  - Issue standards to reduce emissions from cars and trucks and non-road sources.
  - Implement permitting requirements and voluntary programs to promote energy efficiency and encourage design and construction of more efficient processes.
  - http://www.epa.gov/planandbudget/strategicplan.html

- National Aeronautics and Space Administration. The 2011 NASA Strategic Plan states as its Strategic Goal 3: *Create the innovative new space technologies for our exploration, science, and economic future* and Strategic Goal 4: *Advance aeronautics research for societal benefit.* In pursuing these goals NASA is conducting projects that support clean energy technologies as described in several strategic objectives, including:

  - Develop innovative solutions and technologies to meet future capacity and mobility requirements of the Next Generation Air Transportation System (NextGen).
  - Develop tools, technologies, and knowledge that enable significantly improved performance and new capabilities for future air vehicles.
  - Create a pipeline of new innovative concepts and technologies with early-stage Technology Readiness Levels (TRL) for future NASA missions and national needs.
  - Develop advanced technologies to improve the overall safety of the future air transportation system.
  - http://www.nasa.gov/pdf/516579main_NASA2011StrategicPlan.pdf

- National Science Foundation. NSF's Strategic Plan for 2011-2016 includes a performance goal to *Make investments that lead to results and resources that are useful to society* (Performance Goal I-1). NSF investments underpin long-term solutions to societal challenges such as economic development, climate change, clean energy, and cyber-security:

- Near-term actions include expanding partnerships and collaborations with industry or Government agencies in identifying areas of critical national need and piloting models for investing in priority areas having societal impact.
- Mid-term actions include issuing solicitations and Dear Colleague Letters in areas of critical national need.
- Long-term actions include conducting an impact assessment of the portfolio investments in areas of national need.
- http://www.nsf.gov/news/strategicplan/nsfstrategicplan_2011_2016.pdf

- Nuclear Regulatory Commission. Nuclear is considered a clean energy source, and research at NRC to support its regulatory requirements helps maintain nuclear as part of the clean energy mix going forward. Per the NRC's Strategic Plan, the agency's mission is to protect public health and safety, promote the common defense and security, and protect the environment. NRC's strategic goal on safety: *Ensure adequate protection of public health and safety and the environment* supports clean energy technology by:

    - Implementing focused research programs to anticipate and support resolution of safety issues and address new technologies and conduct research programs to identify and support resolution of longstanding and emergent safety issues.
    - http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1614/v5/sr1614v5.pdf

- Tennessee Valley Authority. In August 2010, TVA adopted a renewed vision to be one of the nation's leading providers of low-cost and cleaner energy by 2020. TVA's Strategic Plan supports a shift to a cleaner, more efficient and more diverse generating portfolio providing direction to projects, partnerships, and research and development related to:

    - Idling or retiring aging coal units.
    - Increasing generation from nuclear and renewable resources.
    - Promoting energy efficiency and demand response.
    - Exploring and embracing effective new technologies.
    - http://www.tva.com/abouttva/pdf/TVA4-33149_strategic_plan.pdf

Table 3

Clean Energy Technologies

Details by Agency/Account

(Budget authority in millions of dollars)[1]

Clean Energy Technologies[1]	FY 2012 Enacted Budget Authority	FY 2013 Enacted Budget Authority	FY 2013 Current Budget Authority[10]	FY 2014 Proposed Budget Authority	Proposed Change in Budget Authority 2013-2014
Department of Agriculture					
Natural Resources Conservation Service – Conservation Operations	6	6	0	4	-2
Agricultural Research Service – Salaries and Expenses	33	32	32	39	+7
National Institute of Food and Agriculture - Research and Education Activities	31	57	56	51	-5
Forest Service – Commercialization/Renewable Energy	26	23	23	28	+5
Rural Business Cooperative Service – Value Added Producer Grants (Cooperative Development Grants)	1	2	1	1	-1
Rural Business Cooperative Service – Rural Energy Program Account (Rural Energy for America Sec. 9007)	3	3	3	20	+16
Rural Business Cooperative Service –Guaranteed Business and Industry Loans	4	6	5	6	---
Rural Business Cooperative Service – Rural Economic Development Loans[3]	0	0	0	0	---
Economic Research Service[4]	2	2	2	2	---
Office of the Chief Economist - Salaries and Expenses[5]	4	3	3	4	+1
Rural Utilities Service - High Cost Energy Grants[6]	4	4	4	0	-4
2008 Farm Bill, Mandatory Funding					
Rural Business Cooperative Service – Rural Energy Program Account (Rural Energy for America Sec. 9007)	22	0	0	70	+70
National Institute of Food and Agriculture – Biomass Research and Development (Sec. 9008)	40	0	0	26	+26
Farm Service Agency – Biomass Crop Assistance Program	17	0	0	0	---
Farm Service Agency – Commodity Credit Corporation	0	170	161	0	-170
Natural Resources Conservation Service – Farm Security and Rural Investment Programs	16	14	14	14	---
Rural Business Cooperative Service – Energy Assistance Payments (formerly titled Bioenergy Program for Advanced Biofuels (Sec. 9005))	65	0	0	0	---

Clean Energy Technologies[1]	**FY 2012 Enacted Budget Authority**	**FY 2013 Enacted Budget Authority**	**FY 2013 Current Budget Authority**[10]	**FY 2014 Proposed Budget Authority**	**Proposed Change in Budget Authority 2013-2014**
Subtotal – USDA discretionary funding	*116*	*138*	*130*	*155*	*+18*
Subtotal – USDA mandatory funding	*160*	*184*	*175*	*110*	*-74*
Subtotal – USDA[7]	**275**	**322**	**305**	**265**	**-57**
Department of Commerce					
National Institute of Standards and Technology (NIST) – Scientific and Technological Research and Services	40	40	40	40	---
National Oceanic and Atmospheric Administration Operations, Research and Facilities	0	0	0	3	+3
Subtotal – Commerce[7]	**40**	**40**	**40**	**43**	**+3**
Department of Defense					
Research, Development, Test and Evaluation, Army	32	29	29	32	+2
Research, Development, Test and Evaluation, Navy	231	186	176	226	+40
Research, Development, Test and Evaluation, Air Force	118	203	190	153	-50
Research, Development, Test and Evaluation, Defense Wide	101	46	42	46	---
Subtotal – DOD[7]	**481**	**465**	**437**	**457**	**-8**
Department of Energy					
Energy Efficiency and Renewable Energy	1,819	1,810	1,719	2,788	+978
Electricity Delivery and Energy Reliability	133	133	126	153	+20
Nuclear Energy	772	765	723	733	-32
Fossil Energy R&D – Carbon Capture and Storage (CCS) and Power Systems	472	446	425	375	-71
Science – Fusion, Sequestration, and Hydrogen	902	924	883	1,067	+143
Energy Transformation Acceleration Fund - Advance Research Projects Agency- Energy (ARPA-E)	275	264	251	379	+114
Bonneville Power Administration Fund[9]	15	17	17	17	---
Race to the Top for Energy Efficiency and Grid Modernization	0	0	0	200	+200
HomeStar	0	0	0	300	+300
Energy Security Trust	0	0	0	200	+200
Subtotal – DOE[7]	**4,388**	**4,359**	**4,144**	**6,212**	**+1,853**

Clean Energy Technologies[1]	**FY 2012 Enacted Budget Authority**	**FY 2013 Enacted Budget Authority**	**FY 2013 Current Budget Authority**[10]	**FY 2014 Proposed Budget Authority**	**Proposed Change in Budget Authority 2013-2014**
Department of Transportation					
National Highway Traffic Safety Administration - Operations and Research	10	10	8	11	+1
Research and Innovative Technology Administration – Research and Development	1	1	1	1	---
Federal Aviation Administration - Research, Engineering and Development	21	17	20	18	+1
Federal Aviation Administration - Facilities and Equipment	7	5	4	5	+1
Federal Transit Administration - Research and University Research Centers and Formula and Bus Grants	52	23	22	15	-8
Federal Railroad Association - Railroad Research and Development	1	2	1	3	+1
Subtotal – DOT[7]	**91**	**57**	**56**	**52**	**-5**
Environmental Protection Agency					
Environmental Programs and Management	99	99	95	106	+7
Science and Technology	18	17	16	10	-7
Subtotal – EPA[7]	**117**	**116**	**111**	**115**	**---**
National Aeronautics and Space Administration					
Aeronautics	259	262	255	284	+22
Exploration	9	7	6	9	+1
Space Technology	28	15	15	28	+14
Subtotal – NASA[7]	**296**	**284**	**276**	**321**	**+37**
National Science Foundation					
Research and Related Activities	**341**	**352**	**346**	**372**	**+20**
Nuclear Regulatory Commission					
Salaries and Expenses[8]	**83**	**82**	**57**	**86**	**+4**
Tennessee Valley Authority					
Tennessee Valley Authority Fund[9]	**9**	**11**	**11**	**10**	**-1**
Total[7]	**6,121**	**6,088**	**5,783**	**7,933**	**+1,845**

Clean Energy Technologies[1]	FY 2012 Enacted Budget Authority	FY 2013 Enacted Budget Authority	FY 2013 Current Budget Authority[10]	FY 2014 Proposed Budget Authority	Proposed Change in Budget Authority 2013-2014

Footnotes:

[1] All data supersede numbers released with the 2014 President's Budget and are current as of June 21, 2013. Budget authority provided in millions of dollars. Discrepancies may result from rounding and improved estimates.

[3] Funding for the Rural Business Cooperative Service - Rural Economic Development Loans was less than $500,000 in FY 2012 and FY 2013.

[4] USDA's Economic Research Service has been included in the FCCER, this funding is used to conduct research on the economics of renewable energy.

[5] Office of the Chief Economist includes USDA's Climate Change Program Office and The Office of Energy Policy and New Uses (OEPNU) Research and Development

[6] The Rural Utilities Service - High Cost Energy Grants program has activities to support the creation and use of renewable energy and energy efficiencies.

[7] Agency subtotals and table total may not sum due to rounding.

[8] Nuclear Regulatory Commission funding has been included in the FCCER and reflects funding for nuclear energy research.

[9] Tennessee Valley Authority funding has been added to the FCCER and reflects funding for small modular nuclear reactors research as well as R&D relating to the deployment of nuclear technologies, reduction of greenhouse gas emissions, renewable generation, post-combustion carbon dioxide capture technologies, air quality, energy efficiency and demand response.

[10] Current Budget Authority for FY 2013 throughout this document reflects the amount the program has available for the year calculated as the appropriated amount (as reported in the FY 2013 Enacted column) minus the reductions pursuant to the Budget Control Act of 2011 (P.L. 112-25) sequestration order issued on March 1, 2013, and accounting for any known and applicable reprogrammings, transfers, or other related adjustments. Estimates are current as of June 21, 2013 and are subject to change.

4. INTERNATIONAL ASSISTANCE

The Administration has taken a whole-of-government approach to pursue four broad international climate change financing objectives within its international assistance programs: 1) Demonstrate continued U.S. leadership in forging a global solution to the climate challenge; 2) Help developing countries focus their climate investments strategically over the coming years; 3) Create robust means of measuring, monitoring, and verifying domestic emissions in developing countries; and 4) Reduce vulnerability to climate change. Coordinating and integrating activities from across the U.S. government promotes complementarities that enhance the value of U.S. climate-related financing and increased the likelihood of successfully realizing these four objectives.

Although the Administration's efforts to address climate change are diverse, its bilateral and multilateral international climate change financing is focused on three policy pillars: adaptation, clean energy, and sustainable landscapes. These three policy pillars invest in significant emissions reduction strategies as well as activities that help communities adapt to a changing climate. Key results and indicators to measure progress have been identified for activities in these policy pillars and can be mapped to the Administration's four broad objectives. These activities will strengthen our relationships with other nations, help mitigate the security risk that climate change poses as a threat multiplier in the developing world, support our efforts for a comprehensive, multilateral approach to climate change that involves meaningful actions by all major economies, and create economic opportunities for manufacturers of clean energy technologies.

In its FY 2014 Budget, the Administration is seeking $837 million for core international efforts to combat global climate change, which represents a 5 percent increase from the FY 2013 enacted level. These efforts, conducted by the U.S. Agency for International Development, the U.S. Department of State, and the U.S. Department of the Treasury, will help the most vulnerable countries respond to the growing impacts of climate change, and help forge a global solution to the climate crisis.

The core activities are complemented by an estimated $56 million that is being sought for programs conducted by a range of additional U.S. agencies that address climate change internationally.

In addition to the funding summarized in Table 4, USAID, State, and Treasury will be implementing other programs, such as food security programs or biodiversity programs, in ways that will make a significant contribution to the fight against climate change. Programs focused primarily on non-climate change goals may promote "climate-proofed" development or use adjusted techniques to significantly reduce emissions while promoting other development goals and thereby deliver climate change mitigation and adaptation co-benefits. The Administration estimates the FY 2014 budget authority for these programs to be $216 million.[3] Furthermore, the Administration is enhancing U.S. efforts to address global climate change and promote clean energy technologies in important ways beyond those programs with direct appropriations. Through direct loans, loan guarantees, insurance, and working capital guarantees, U.S. development finance and export credit agencies are increasingly mobilizing investments in clean energy technologies around the world.[4] These U.S. Government financial products will help American firms, financial institutions, and investors, with their foreign partners, address climate change in developing countries, offering global benefits.

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[3] Summary of the "whole of government" U.S. International Climate Change Financing is available at http://www.state.gov/documents/organization/201130.pdf

Together, these activities will substantially contribute to the international community's renewed efforts to address climate change, including through the implementation of the Copenhagen Accord, and make clear the Administration's commitment to international leadership in the necessary transition to a low emission economy.

4.1 AGENCY HIGHLIGHTS REGARDING INTERNATIONAL CLIMATE CHANGE ASSISTANCE

- **U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT (USAID)**

  USAID is the lead contributor to bilateral assistance, with a focus on capacity building, civil society building, governance programming, and creating the legal and regulatory environments needed to address climate change. USAID will leverage its significant technical expertise to provide leadership in development and implementation of low-carbon strategies, creating policy frameworks for market-based approaches to emissions reduction and energy sector reform, promoting sustainable management of agriculture lands and forests, and mainstreaming adaptation into development activities in countries most at risk. USAID has long-standing relationships with host country governments that will enable it to develop shared priorities and implementation plans. USAID's engagement and expertise in agriculture, biodiversity, health, and other critical climate sensitive sectors provide an opportunity to implement innovative cross-sector climate change programs. Finally, USAID bilateral programs can work in key political and governance areas that multilateral agencies cannot.

- **DEPARTMENT OF STATE**

  State takes the lead on diplomatic efforts and deploys financial resources in support of key multilateral and bilateral priorities. State's comparative advantage is promoting effective international solutions, advanced technology strategies, and innovative market approaches through international processes and U.S.-led diplomatic partnerships and initiatives.

- **DEPARTMENT OF THE TREASURY**

  The Treasury Department is the primary agency through which the U.S. Government provides contributions through multilateral delivery channels, including the Climate Investment Funds and the Global Environment Facility. Multilateral assistance promotes institutional structures governed jointly by developed and developing countries, which are needed for a coordinated, global response to climate change. Multilateral institutions complement bilateral assistance by leveraging contributions from other donors, making capital investments in infrastructure, providing a range of tailored financial products, and working across a larger number of countries.

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[4] Estimates of development finance and export credit agencies' international climate investments are based on an initial review of planned projects, and in some cases the final review of activities, after their implementation, may change the accounting of timing and scale of financing. http://www.state.gov/documents/organization/201130.pdf

The FY 2014 Budget requests $216 million for the Clean Technology Fund (CTF), which aims to close the price gap in developing countries between dirtier conventional technologies and commercially available cleaner alternatives in the power sector, the transportation sector, and in energy efficiency. The CTF focus is on transforming energy use on a sector scale in the "larger emitter" developing countries.

In addition, the FY 2014 Budget requests $68 million for the Strategic Climate Fund in three programs: the Pilot Program for Climate Resilience, the Forest Investment Program, the program for Scaling-up Renewable Energy in Low Income Countries (SREP). The Pilot Program for Climate Resilience will help finance comprehensive efforts to improve the technical capacity of countries to plan for and finance climate adaptation efforts. The Forest Investment Program will support activities informed by national plans to reduce deforestation and will focus on transitioning a small number of developing countries to participate in carbon financing for forest preservation. SREP aims to demonstrate how to put the poorest countries on a pathway that uses renewable energy to expand energy access and stimulate economic growth.

- **DEPARTMENT OF COMMERCE**

The Department of Commerce manages the Renewable Energy and Energy Efficiency Export Initiative (RE4I) through its leadership of the TPCC Working Group on Renewable Energy and Energy Efficiency. The RE4I is a key, sector-specific initiative designed to meet the specific needs of the clean energy sector, while also advancing the President's goal of doubling exports. It includes contributions from eight U.S. Government agencies and is meant to facilitate the deployment of renewable energy and energy efficiency (RE&EE) technologies; better link buyers and sellers of RE&EE products and services; open markets for U.S.-made RE&EE technologies; improve U.S. Government financing for RE&EE exporters; and enhance two-way communication between the U.S. Government and the RE&EE industry. Under the auspices of the RE4I, Commerce has facilitated several improvements to the U.S. Government's trade promotion process in the RE&EE sector, including the development of RE&EE trade policy missions to support existing trade promotion activities by helping to create new markets for U.S. RE&EE companies in countries with nascent policy framework and regulatory systems. This has resulted in highly successful missions to Mexico, Japan, Chile, and Saudi Arabia. Commerce has also developed a first-of-its-kind Renewable Energy Top Prospects Study to help the interagency direct trade promotion activities toward those markets most likely to support U.S. exports.

- **COMPLEMENTARY AGENCIES**

In addition to the core international assistance activities, a number of additional agencies provide technical and in some cases direct support for international efforts to address climate change. Two international agencies, the Millennium Challenge Corporation (MCC) and the U.S. Trade and Development Agency (USTDA), work directly with international partners on projects that may have climate change benefits.

MCC works with its foreign government partners on programs that reduce poverty through sustainable economic growth. In undertaking its poverty reduction programs, MCC seeks to integrate climate change considerations, such as adaptation and reduced emissions, where appropriate. For example, MCC clean energy capital investments may support economic development priorities with ancillary benefits in emissions reductions. MCC agriculture and agricultural infrastructure programs, such as irrigation, may integrate more sustainable use of water resources in those areas at risk of increasing water scarcity in a changing climate.

USTDA has a number of programs that combine support for U.S. exports with a focus on emissions reductions abroad. USTDA provides technical assistance to developing countries on clean energy technologies that U.S. firms provide, organizes visits for foreign entities seeking business opportunities with U.S. firms in the renewable energy sector, and funds studies on future clean energy infrastructure investments.

A number of domestic agencies with significant technical expertise complement the core international assistance activities on climate change through a variety of functions. The Department of Energy and the Environmental Protection Agency provide technical assistance on clean energy investments and environmental regulations undertaken by foreign governments; National Aeronautics and Space Administration and the National Science Foundation provide research and science assistance to the core international assistance agencies that directly supports climate change efforts; and the Forest Service works with USAID on a number of forestry programs that reduce emissions through carbon sequestration.

4.2 LINKAGES TO STRATEGIC PLANS

Interagency Strategic Plans and Planning Documents

- Meeting the Fast Start Commitment – US Climate Finance in Fiscal Year 2012. The Fast Start document released in November 2012 describes the $7.5 billion provided during the three-year fast start finance period from 2010-2012. The three-year fast start finance total consists of more than $4.7 billion of Congressionally-appropriated assistance and more than $2.7 billion from U.S. development finance and export credit agencies. http://www.state.gov/documents/organization/201130.pdf
- Fifth Climate Action Report to the UN Framework Convention on Climate Change. The *U.S Climate Action Report 2010* sets out the major actions the U.S. government is taking at the federal level, highlights examples of state and local actions, and outlines U.S. efforts to assist other countries' efforts to address climate change. http://www.state.gov/documents/organization/140636.pdf
- Fact Sheet: U.S. Global Development Policy and Global Climate Change Initiative. In September 2010, the President signed a Presidential Policy Directive on Global Development, which provides clear policy guidance to all U.S. Government agencies and enumerates the core objectives, operational model, and the modern architecture needed to implement the policy. http://www.whitehouse.gov/sites/default/files/Climate_Fact_Sheet.pdf

Individual Agency Strategic Plans and Planning Documents

- USAID. The *Climate Change and Development Strategy/2012-2016*, released in January 2012, describes USAID's efforts to enable countries to accelerate their transition to climate resilient low emission sustainable economic development. To accomplish this, USAID will pursue three strategic objectives:
    - Accelerate the transition to low-emission development through investments in clean energy and sustainable landscapes;
    - Increase resilience of people, places, and livelihoods through investments in adaptation;
    - Strengthen development outcomes by integrating climate change in Agency programming.
    - http://transition.usaid.gov/our_work/policy_planning_and_learning/documents/GCCS.pdf

- State and USAID. The *Quadrennial Diplomacy and Development Review,* released in 2010, describes the whole-of-government approach used by the Global Climate Change Initiative (GCCI). Key GCCI objectives include:
    - Laying the foundation for low-carbon growth by supporting partner country efforts to advance economic growth while reducing emissions;
    - Accelerating the clean energy revolution through multilateral and bilateral mechanisms and promoting development and deployment of clean energy technologies;
    - Reducing emissions from agricultural and other land use and conserving forests through contributions to Reducing Emissions from Deforestation and Forest Degradation (REDD+).
    - http://www.state.gov/s/dmr/qddr/index.htm

Table 4

International Climate Change Assistance

Details by Agency/Account

(Budget authority in millions of dollars) [1]

International Assistance[1,2]	**FY 2012 Enacted Budget Authority**	**FY 2013 Enacted Budget Authority**	**FY 2013 Current Budget Authority**[20]	**FY 2014 Proposed Budget Authority**	**Proposed Change in Budget Authority 2013-2014**
Core Agencies[3]					
Department of State					
Diplomatic and Consular Affairs[4]	0	0	0	0	---
Economic Support Fund	96	95	91	94	-1
International Organizations and Programs	37	37	35	39	+2
Subtotal – State[5]	**133**	**132**	**126**	**133**	**+1**
Department of the Treasury[6]					
Debt Restructuring – Tropical Forestry Conservation	12	12	11	0	-12
Global Environment Facility[7, 18]	60	65	63	72	+7
Clean Technology Fund[18]	230	185	175	216	+31
Strategic Climate Fund[8, 18]	75	50	47	68	+18
Subtotal – Treasury[5]	**377**	**311**	**296**	**356**	**+44**
U.S. Agency for International Development[4]					
Assistance for Europe, Eurasia, and Central Asia[9]	15	0	0	0	---
Development Assistance[19]	322	322	308	317	-5
Economic Support Fund	12	28	27	32	+4
International Disaster Assistance	0	0	0	0	---
Subtotal – USAID[5]	**348**	**334**	**335**	**349**	**-1**
Subtotal- Core Agencies[5]	*858*	*792*	*757*	*837*	*+45*
Complementary Agencies[10]					
US Department of Energy[11]					
Energy Efficiency and Renewable Energy	9	9	9	9	---
Fossil Energy R&D –Carbon Capture and Storage (CCS)	3	3	3	3	---
Science	1	1	1	1	---

International Assistance[1,2]	**FY 2012 Enacted Budget Authority**	**FY 2013 Enacted Budget Authority**	**FY 2013 Current Budget Authority**[20]	**FY 2014 Proposed Budget Authority**	**Proposed Change in Budget Authority 2013-2014**
Subtotal- DOE[5]	**13**	**13**	**13**	**13**	**---**
Environmental Protection Agency					
Environmental Programs and Management[12]	**18**	**18**	**16**	**19**	**---**
National Science Foundation					
Research and Related Activities[14]	**6**	**6**	**6**	**3**	**-3**
Department of Agriculture					
Forest Service-Forest and Rangeland Research[15]	**3**	**3**	**3**	**1**	**-2**
National Aeronautics and Space Administration					
Science[16]	**3**	**3**	**3**	**3**	**---**
Millennium Challenge Corporation					
Millennium Challenge Corporation[17]	**41**	**0**	**0**	**0**	**---**
US Trade and Development Agency					
Trade and Development Agency[21]	**16**	**16**	**0**	**18**	**+1**
Subtotal- Complementary Agencies[5]	*100*	*59*	*40*	*56*	*-3*
Total[5]	**958**	**851**	**797**	**893**	**+42**

Footnotes:

[1] This table shows core climate assistance from programs with climate as a primary objective. In addition, indirect climate assistance is provided through programs in other development sectors such as agriculture, water, and health, that do not necessarily have a primary climate objective but nevertheless may provide climate benefits. Those activities have been captured in the U.S. Fast Start Climate Finance Report.

[2] All data supersede numbers released with the 2014 President's Budget and are current as of June 21, 2013. Budget authority provided in millions of dollars. Discrepancies may result from rounding and improved estimates.

[3] Core agencies for the purposes of the Federal Climate Change Expenditure Report are made of the primary climate assistance activities of the Department of State, Department of the Treasury, and US Agency for International Development (USAID). The Federal Climate Change Expenditures Report contained only these core agencies in previous years.

[4] Diplomatic and Consular Affairs continues to support international climate change activities, but because it is not a foreign assistance account, it has been excluded from the international assistance crosscut, beginning in FY 2011.

[5] Agency subtotals and table total may not add due to rounding.

[6] The FY 2012 totals for Treasury climate programming includes a $100 million transfer from the Department of State.

[7] Only 50% of GEF funds are allocated to programs related to climate change and shown here. The full amounts for GEF over respective columns are 2012—120, 2013 enacted—129, 2013 current—125, and 2014 request—144.

[8] The SCF is the second of the multi-donor Climate Investment Funds. It supports three targeted programs: the Pilot Program for Climate Resilience, the Forest Investment Program, and the Program for Scaling-Up Renewable Energy in Low-Income Countries.

[9] In the 2009 Omnibus appropriation, Congress combined Assistance for Eastern Europe and the Baltic States with Assistance for the Independent States of the Former Soviet Union, making a new account called Assistance for Europe, Eurasia, and Central Asia.

[10] The category of Complementary Agencies was first included in the Federal Climate Change Expenditures Report that followed the FY 2011 President's Budget as a means to account for technical and in some cases direct support for international efforts to address climate change.

[11] DOE funding provides global outreach on advanced clean coal technology and CCS for climate change mitigation and energy security in multilateral forums.

[12] EPA activities include Methane to Markets, International Capacity Building, and contribution to the Multilateral Fund to support the Montreal Protocol on Substances that Deplete the Ozone Layer.

[13] ITA funding represents activities under the Asia Pacific Partnership to promote the development and deployment of cleaner and more efficient energy technologies.

[14] NSF funding is for Basic Research to Enable Agriculture Development (BREAD) through the Directorate for Biological Science.

[15] Forest Service activities include assistance to developing countries to establish and maintain sustainable landscape management.

[16] NASA activities include funding for the SERVIR initiative which consists of two web-based regional monitoring networks to provide environmental (land, sea, atmosphere, biota) information and projections to decision makers in Central America/Caribbean and East Africa.

[17] MCC anticipates applying FY 2013 and FY 2014 funds to support compacts with Ghana, Benin, El Salvador, Morocco, Niger, Tanzania, Liberia, and Sierra Leone, which may include funding to support climate change objectives. Because funds will not be committed until signing of a compact and the projects within each compact are still being developed, MCC cannot yet report FY 2013 and FY 2014 funding that will support climate change objectives.

[18] FY 2012 Enacted includes a $100 million ESF transfer from State to Treasury for the Clean Technology Fund ($45 million), Strategic Climate Fund ($25 million), and the Global Environment Facility ($30 million).

[19] FY 2013 ESF funding includes both ESF Base and ESF OCO funds.

[20] Current Budget Authority for FY 2013 throughout this document reflects the amount the program has available for the year calculated as the appropriated amount (as reported in the FY 2013 Enacted column) minus the reductions pursuant to the Budget Control Act of 2011 (P.L. 112-25) sequestration order issued on March 1, 2013, and accounting for any known and applicable reprogrammings, transfers, or other related adjustments. Estimates are current as of June 21, 2013 and are subject to change.

[21] USTDA provides funding for various forms of investment analysis and technical assistance to promote investment opportunities for U.S. companies in developing countries. USTDA has expanded its clean energy project portfolio dramatically over the last few years.

5. ENERGY TAX PROVISIONS THAT MAY REDUCE GREENHOUSE GASES

This report includes existing energy tax provisions and energy payments in lieu of tax provisions which may reduce greenhouse gases. All references to the Code are intended to refer to the Internal Revenue Code of 1986, unless otherwise specified. Summary descriptions of the provisions are provided below and the associated revenue effects are shown in Table 5. A tax expenditure is an exception to baseline provisions of the tax structure that usually results in a reduction in the amount of tax owed. In addition to categories of tax expenditures described in previous Federal climate change expenditures reports, this report contains estimated payments from the Department of the Treasury authorized by Section 1603 of the American Recovery and Reinvestment Act.

All tax expenditure estimates presented here were based upon current tax law enacted as of December 31, 2012. Expired or repealed provisions are not listed if their revenue effects result only from taxpayer activity occurring before fiscal year 2012. Tax expenditure information can also be found in *Analytical Perspectives, Budget of the United States Government*, Fiscal Year 2014, Chapter 16.[5]

Energy production credit – The Code provides a credit for certain electricity produced from wind energy, biomass, geothermal energy, solar energy, small irrigation power, municipal solid waste, qualified hydropower production, or marine and hydrokinetic renewable energy, and sold to an unrelated party.

Energy investment credit – The Code provides credits for investments in solar and geothermal energy property, qualified fuel cell property, qualified microturbine property, geothermal heat pumps, qualified small wind property and combined heat and power property. Owners of renewable power facilities that qualify for the energy production credit may instead elect to take an energy investment credit.

Credit for alternative motor vehicles and refueling property – The Code allows a number of credits for certain types of vehicles and property. These are available for alternative fuel vehicle refueling property, fuel cell vehicles and plug-in electric drive motor vehicles.

Exclusion of utility conservation subsidies – In certain circumstances, public utilities offer rate subsidies to non-business customers who invest in energy conservation measures.

Credit for holding clean renewable energy bonds – The Code provides for the issuance of Clean Renewable Energy Bonds which entitles the bond holder to a Federal income tax credit in lieu of interest. The limit on the volume issued in 2009-2010 is $2.4 billion.

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[5] Several temporary provisions, including the energy production tax credit, the energy investment credit, the credit for refueling property, the credit for energy efficient improvements to existing homes, the credit for construction of new energy efficient homes, and the credit for energy efficient appliances, were extended or modified under the American Taxpayer Relief Act of 2012. The tax expenditure estimates in this report do not reflect the extension of these tax incentives.

Allowance of deduction for certain energy efficient commercial building property – The Code allows a deduction, per square foot, for certain energy efficient commercial buildings property installed on or in a commercial building.

Credit for construction of new energy efficient homes – The Code allows contractors a tax credit of $2,000 for the construction of a qualified new energy-efficient home with an annual level of heating and cooling energy consumption at least 50 percent below a reference energy standard. The Code also allows a tax credit of $1,000 for the construction of a qualified new energy-efficient manufactured home with an annual level of heating and cooling energy consumption at least 30 percent below a reference energy standard.

Credit for energy efficiency improvements to existing homes – The Code provides an investment tax credit for expenditures made on insulation, exterior windows (including skylights), exterior doors, and metal or asphalt roofs with appropriate pigmented coatings or cooling granules that improve the energy efficiency of a home and meet certain standards. The Code also provides a credit for purchases of advanced main air circulating fans, natural gas, propane, or oil furnaces or hot water boilers, and other qualified energy efficient property.

Credit for residential energy efficient property – The Code provides an investment tax credit for expenditures made on solar electric property, solar hot water heaters, fuel cells, small wind turbines, and geothermal heat pumps for use in a residence.

Credit for energy efficient appliances – The Code provides tax credits for the manufacture of energy efficient dishwashers, clothes washers, and refrigerators. The amount of the tax credit depends on the energy efficiency of the appliance.

Advanced energy property credit – The Code provides a 30 percent investment credit for property used in a qualified advanced energy manufacturing project. The Treasury Department may award up to $2.3 billion in tax credits for qualified investments.

Credit for qualified energy conservation bonds – The Code provides for the issuance of energy conservation bonds which entitle the bond holder to a Federal income tax credit in lieu of interest. The limit on the volume issued in 2009 is $3.2 billion.

Industrial CO2 capture and sequestration tax credit – The Code allows a credit of $20 per metric ton for qualified carbon dioxide captured at a qualified facility and disposed of in secure geological sequestration. The Code also allows a credit of $10 per metric ton of qualified carbon dioxide that is captured at a qualified facility and used as a tertiary injectant in a qualified enhanced oil or natural gas recovery project.

Energy payments in lieu of energy investment credit – Section 1603 of the American Recovery and Reinvestment Tax Act of 2009 (Section 1603) authorizes the Treasury Department to make payments to persons who place in service specified energy property in 2009, 2010, or 2011 or whose construction commenced in 2009, 2010, or 2011. Firms can take an energy payment in lieu of the energy production credit or the energy investment credit.

Table 5

Energy Tax Provisions That May Reduce Greenhouse Gases

(Revenue effect in millions of dollars)

	2012	2013	2014	2015	2016	2017	2018	2014-2018
Energy Production Credit (without coal)[1]	1,452	1,719	1,759	1,719	1,629	1,428	1,088	7,622
Energy Investment Credit[2]	1,040	1,270	1,360	1,670	1,880	1,110	240	6,260
Tax credit for alternative motor vehicles and refueling property[3]	100	180	260	400	610	670	500	2,440
Exclusion of utility conservation subsidies	270	250	250	250	250	250	240	1,240
Credit for holding clean renewable energy bonds	70	70	70	70	70	70	70	350
Allowance of deduction for certain energy efficient commercial building property	70	70	40	20	0	0	-20	40
Credit for construction of new energy efficient homes	70	40	20	0	0	0	0	20
Credit for energy efficiency improvements to existing homes	780	0	0	0	0	0	0	---
Credit for energy efficient appliances	210	300	130	120	100	0	0	350
Credit for residential energy efficient properties[4]	910	1,010	1,140	1,270	1,420	600	0	4,430
Qualified energy conservation bonds	20	30	30	30	30	30	30	150
Industrial CO2 capture and sequestration tax credit	60	60	70	80	110	210	160	630
Tax Provisions Subtotal	*5,052*	*4,999*	*5,129*	*5,629*	*6,099*	*4,368*	*2,308*	*23,532*
Energy Payments in lieu of energy investment credit[2,5]	*5,080*	*8,080*	*4,710*	*2,520*	*1,580*	*330*	*0*	*9,140*
Tax Provisions plus Energy Payments Total	**10,132**	**13,079**	**9,839**	**8,149**	**7,679**	**4,698**	**2,308**	**32,672**

Footnotes:

[1] Estimates of revenue loss from coal provisions have been removed from the tax expenditure estimate in the budget. In previous years, the Expenditures Report cited the New Technology Credit.

[2] In previous years the Energy Investment Credit was contained within the New Technology Credit. The Energy Investment Credit also includes the business installation of fuel cells, which was an independent entry in tables from previous years. These estimates do not exclude microturbine credits which were removed in previous expenditures reports, however the estimates are expected to be too small to affect these figures which are rounded to the nearest $10 million.

[3] In previous reports the tax credit for alternative motor vehicles and refueling property was referred to as the tax credit and deduction for clean-burning vehicles.

[4] In previous years the credit for residential energy efficient property was referred to as the credit for residential purchases/installations of solar and fuel cells.

[5] Firms can take an energy payment in lieu of the energy investment credit for facilities placed in service in 2009, 2010, or 2011 or whose construction commenced in 2009, 2010, or 2011. The payments are considered outlays and are direct substitutes for the energy tax provisions.

6. CLIMATE ADAPTATION, PREPAREDNESS, AND RESILIENCE

Climate change is a complex, interdisciplinary issue with the potential to affect nearly every sector and level of governmental operations. Across the United States and the world, climate change is already affecting communities, livelihoods, and the environment. To address these challenges and ensure the nation is prepared and resilient to the impacts of climate change, in 2009, the Administration convened the Interagency Climate Change Adaptation Task Force, co-chaired by the Council on Environmental Quality (CEQ), the Office of Science and Technology Policy (OSTP), and the National Oceanic and Atmospheric Administration (NOAA), and including representatives from more than 20 Federal agencies. In addition, on October 5, 2009, President Obama signed an Executive Order directing the Task Force to develop recommendations for how the Federal Government can strengthen policies and programs to better prepare the nation to adapt to the impacts of climate change.

In its 2010 Progress Report, the Task Force called on Federal agencies to demonstrate leadership on climate change adaptation. Rising sea levels, drought, extreme weather events, loss of land and sea ice, and other climate-related impacts threaten communities, ecosystems, and Federal services and assets. The 2010 Task Force Report determined that the Federal Government has a responsibility to safeguard Federal services and resources and to help states, tribes, and communities manage climate-related risks by improving access to climate information, enhancing coordination and capacity, and leading and supporting actions that reduce vulnerability and increase resilience. In response, Federal agencies are taking steps to prepare the nation for the impacts of climate change and are making significant progress. These actions are outlined in agencies' first ever Climate Change Adaptation Plans, which were released in February 2013 as part of the annual Strategic Sustainability Planning Process. These plans outline initiatives to reduce the vulnerability of Federal programs, assets, and investments to the impacts of climate change, such as sea level rise or more frequent or severe extreme weather. Agency adaptation plans highlight actions to plan for and address these impacts in their programs and operations, and protect taxpayer investments.

Agencies are also developing collaborative approaches within the government to build coordinated and comprehensive responses to the impacts of climate change in all sectors. The first of these efforts have focused on building the climate preparedness and resilience of natural resources, including oceans and coasts, wildlife, and water resources. Federal agencies worked with stakeholders to develop a National Action Plan for managing freshwater resources in a changing climate to assure adequate water supplies and protect soil and water quality, human health, property, and aquatic ecosystems. Federal agencies also worked with state, tribal, and local representatives to develop a National Fish, Wildlife and Plants Climate Adaptation Strategy, for safeguarding our nation's species and natural resources (http://www.wildlifeadaptationstrategy.gov). The final strategy was released in March 2013.

There are numerous efforts across the Federal Government for preparing and building resilience to the impacts of climate change on various critical sectors, institutions, and agency mission responsibilities. The President's Climate Action Plan highlights many key efforts to advance climate adaptation, preparedness and resilience. Successful efforts to build resiliency and adaptation often involve integrating climate change considerations into existing agency programs, projects, and activities rather than establishing separate and distinct programs. This creates a challenge when attempting to fully account for all adaptation resources. While the Administration continues to develop methodologies to account for a broader suite of adaptation programs across all critical sectors, this report used the following summary of Department of the Interior activities designed to promote adaptation as an example of one agency's efforts in this area. These Department of the Interior activities also reflect a variety of interagency efforts to address key adaptation challenges that cut across the jurisdictions and missions of individual Federal agencies, and affect fresh water, oceans and coasts, and fish, wildlife and plants.

An early example of agency efforts to promote climate preparedness and resilience is the work of the Department of the Interior to gain effective and broad collaboration to determine the causes and implement changes to reduce climate impacts to lands, waters, natural and cultural resources.

A key component of this initiative is the development of a network of Landscape Conservation Cooperatives (LCCs), which are applied conservation science partnerships that provide scientific and technical support for spatially-explicit conservation goals and for integrated, adaptive management actions at landscape scales. LCCs are composed of and depend on other Federal agencies, tribal, local and State partners, and the public in crafting practical, landscape-level strategies for managing climate change impacts in coordination with the Department's Climate Science Centers (CSCs). The focus of the CSCs includes impacts of climate change on fish, wildlife, and habitats, including wildlife migration patterns, wildfire risk, drought, or invasive species that typically extend beyond the borders of any particular Federal or Tribal land holding.

With resident staff and through connections with partners, LCCs develop, test, implement, and monitor conservation strategies that respond to the dynamic landscape changes resulting from climate change. The LCCs facilitate broad availability of data, modeling, and tools to land managers that allow them to analyze and model trends in species and habitat changes. LCCs also support improved management of water resources, historical and cultural resources, and resources that are needed by Indian Tribes and Alaska Natives.

The FY 2014 President's Budget continues support for cooperative landscape conservation in the face of climate change and other environmental stressors. The National Park Service supports managers with the tools to inventory changes and adapt management practices with a $6 million increase. The Bureau of Indian Affairs provides a $9 million increase to better integrate climate adaptation work on trust land and to support Tribal participation with the CSC and the Landscape Conservation Cooperatives, including the use of traditional ecological knowledge in adaptation management. These funding levels provide the critical science to support Interior's $110 million Climate Change Wildlife Adaptation initiative. The Bureau of Reclamation continues to support cooperative landscape conservation, focusing on climate change implications for water resources management and addressing the Department's Priority Goal for Climate Change through vulnerability assessments, adaptation actions, and development of improved assessment tools through collaboration with CSCs and other climate science entities.

Table 6

Natural Resources Adaptation

(Budget authority in millions of dollars) [1]

Natural Resources Adaptation[1]	FY 2012 Enacted Budget Authority	FY 2013 Enacted Budget Authority	FY 2013 Current Budget Authority[3]	FY 2014 Proposed Budget Authority	Proposed Change in Budget Authority 2013-2014
Department of Interior					
National Park Service – Operation of the National Park Service	3	3	3	9	+6
Fish and Wildlife Service – Resource Management	60	67	64	65	-2
Bureau of Land Management – Management of Lands and Resources	18	18	16	21	+3
Bureau of Indian Affairs – Operation of Indian Programs[2]	0	1	1	10	+9
Bureau of Reclamation – Cooperative Landscape Conservation	7	6	6	5	-1
Total – Natural Resources Adaptation	**88**	**95**	**90**	**110**	**+15**

Footnotes:

[1] All data supersede numbers released with the 2014 President's Budget. Budget Authority provided in millions of dollars. Discrepancies resulted from rounding and improved estimates. Funding in the table does not include USGS climate change adaptation research, which is captured within USGCRP totals.

[2] BIA activities include: assisting Tribes and Alaska Natives with land and resource management, and adaptive management strategies to deal with the effects of climate change they are experiencing or expect to experience; providing climate change funds to Tribes for mitigation and adaptation projects that are deemed high priority; and provide climate change funds for Tribes to actively engage and participate in the Climate Science Centers, LCCs, and the many other climate change implementation projects that require tribal input.

[3] Current Budget Authority for FY 2013 throughout this document reflects the amount the program has available for the year calculated as the appropriated amount (as reported in the FY 2013 Enacted column) minus the reductions pursuant to the Budget Control Act of 2011 (P.L. 112-25) sequestration order issued on March 1, 2013, and accounting for any known and applicable reprogrammings, transfers, or other related adjustments. Estimates are current as of June 21, 2013 and are subject to change.

APPENDIX

ACCOUNTING OF FEDERAL CLIMATE CHANGE EXPENDITURES BY AGENCY

Table 7

Climate Change Expenditures by Agency

Details by Agency/Account
(Budget authority in millions of dollars)[1]

The following is a listing of Federal climate change expenditures by agency and by line item in the President's 2014 Budget Appendix. Budget Appendix line items show account level data and may not reflect sub-account level climate change information. The data in this table may be subsets of an account.

Climate Change Expenditures by Agency	FY 2012 Enacted Budget Authority	FY 2013 Enacted Budget Authority	FY 2013 Current Budget Authority[2]	FY 2014 Proposed Budget Authority	Change in Budget Authority 2013-2014
Department of Agriculture					
Global Change Research Program					
Agricultural Research Service	36	36	38	52	+16
National Institute of Food and Agriculture	50	40	40	43	+3
Economic Research Service	2	2	2	2	---
Forest Service – Forest and Rangeland Research	26	25	25	28	+3
National Agricultural Statistics Service	1	1	1	1	---
Natural Resources Conservation Services	1	1	1	1	---
USDA- GCRP Subtotal	**116**	**104**	**106**	**126**	**22**
Clean Energy Technology					
Natural Resources Conservation Service – Conservation Operations	6	6	0	4	-2
Agricultural Research Service – Salaries and Expenses	33	32	32	39	+7
National Institute of Food and Agriculture – Research and Education Activities	31	57	56	51	-5
Forest Service – Commercialization/Renewable Energy	26	23	23	28	+5
Rural Business Service – Value Added Producer Grants (Cooperative Development Grants)	1	2	1	1	-1
Rural Business Service – Rural Energy for America Program	3	3	3	20	+16
Rural Business Cooperative Service – Guaranteed Business and Industry Loans	4	6	5	6	---
Rural Business Cooperative Service – Rural Economic Development Loans	0	0	0	0	---
Economic Research Service	2	2	2	2	---
Office of the Chief Economist – Salaries and Expenses	4	3	3	4	+1
Rural Utilities Service – High Cost Energy Grants	4	4	4	0	-4

Climate Change Expenditures by Agency	**FY 2012 Enacted Budget Authority**	**FY 2013 Enacted Budget Authority**	**FY 2013 Current Budget Authority[2]**	**FY 2014 Proposed Budget Authority**	**Change in Budget Authority 2013-2014**
2008 Farm Bill, Mandatory Funding					
Rural Business Service – Rural Energy for America	22	0	0	70	+70
National Institute of Food and Agriculture – Biomass Research and Development	40	0	0	26	+26
Farm Service Agency – Biomass Crop Assistance Program	17	0	0	0	---
Farm Service Agency – Commodity Credit Corporation	0	170	161	0	-170
Natural Resources Conservation Service – Farm Security and Rural Investment Programs	16	14	14	14	---
Rural Business Service – Bioenergy Program for Advanced Biofuels	65	0	0	0	---
Subtotal - mandatory funding	*160*	*184*	*175*	*110*	*-74*
Subtotal - discretionary funding	*116*	*138*	*130*	*155*	*+18*
USDA- Clean Energy Subtotal	**275**	**322**	**305**	**265**	**-57**
International Assistance					
Forest Service-Forest and Rangeland Research	**3**	**3**	**3**	**1**	**-2**
Total-USDA	**394**	**429**	**414**	**392**	**-37**
Department of Commerce					
Global Change Research Program					
National Oceanic and Atmospheric Administration – Operations, Research, and Facilities	245	247	233	307	+60
National Oceanic and Atmospheric Administration – Procurement, Acquisition, and Construction	69	64	64	59	-5
National Institute of Standards and Technology (NIST)	5	5	5	5	---
DOC- GCRP Subtotal	**319**	**316**	**302**	**371**	**+55**
Clean Energy Technology					
National Institute of Standards and Technology (NIST) – Scientific and Technological Research and Services	40	40	40	40	---
National Oceanic and Atmospheric Administration Operations, Research and Facilities	0	0	0	3	+3
DOC- Clean Energy Subtotal	**40**	**40**	**40**	**43**	+3
Total- Department of Commerce	**359**	**356**	**342**	**414**	**+58**

Climate Change Expenditures by Agency	**FY 2012 Enacted Budget Authority**	**FY 2013 Enacted Budget Authority**	**FY 2013 Current Budget Authority[1]**	**FY 2014 Proposed Budget Authority**	**Change in Budget Authority 2013-2014**
Department of Defense					
Clean Energy Technology					
Research, Development, Test and Evaluation, Army	32	29	29	32	+2
Research, Development, Test and Evaluation, Navy	231	186	176	226	+40
Research, Development, Test and Evaluation, Air Force	118	203	190	153	-50
Research, Development, Test and Evaluation, Defense Wide[5]	101	46	42	46	---
Total- Department of Defense	**481**	**465**	**437**	**457**	**-8**
Department of Energy					
Global Change Research Program					
Science – Biological & Environmental Research	**211**	**213**	**209**	**220**	+7
Clean Energy Technology					
Energy Efficiency and Renewable Energy	1,819	1,810	1,719	2,788	+978
Electricity Delivery and Energy Reliability	133	133	126	153	+20
Nuclear Energy	772	765	723	733	-32
Fossil Energy R&D – Carbon Capture and Storage (CCS) and Power Systems	472	446	425	375	-71
Science – Fusion, Sequestration, and Hydrogen	902	924	883	1,067	+143
Energy Transformation Acceleration Fund – Advance Research Projects Agency- Energy (ARPA-E)	275	264	251	379	+114
Bonneville Power Administration Fund	15	17	17	17	---
Race to the Top for Energy Efficiency and Grid Modernization	0	0	0	200	+200
HomeStar	0	0	0	300	+300
Energy Security Trust	0	0	0	200	+200
DOE- Clean Energy Subtotal	**4,388**	**4,359**	**4,144**	**6,212**	**+1,853**
International Assistance					
Energy Efficiency and Renewable Energy	9	9	9	9	---
Fossil Energy R&D – Carbon Capture and Storage (CCS) and Power Systems	3	3	3	3	---
Science	1	1	1	1	---
DOE- International Assistance Subtotal	**13**	**13**	**13**	**13**	**---**
Adjustments for programs included in multiple categories -- DOE	*-13*	*-13*	*-13*	*-13*	---
Total- DOE	**4,599**	**4,572**	**4,353**	**6,432**	**+1,860**

Climate Change Expenditures by Agency	FY 2012 Enacted Budget Authority	FY 2013 Enacted Budget Authority	FY 2013 Current Budget Authority[1]	FY 2014 Proposed Budget Authority	Change in Budget Authority 2013-2014
Department of Health and Human Services					
Global Change Research Program					
Centers for Disease Control and Prevention	6	7	7	7	---
National Institutes of Health	8	8	8	8	---
HHS- GCRP Subtotal	14	15	14	15	---
Total-HHS	**14**	**15**	**14**	**15**	---
Department of the Interior					
Global Change Research Program					
U.S. Geological Survey – Surveys, Investigations, and Research	**59**	**58**	**55**	**72**	**+14**
Natural Resources Adaptation					
National Park Service – Operation of the National Park Service	3	3	3	9	+6
Fish and Wildlife Service – Resource Management	60	67	64	65	-2
Bureau of Land Management – Management of Lands and Resources	18	18	16	21	+3
Bureau of Indian Affairs – Operation of Indian Programs[2]	0	1	1	10	+9
Bureau of Reclamation – Cooperative Landscape Conservation	7	6	6	5	-1
DOI- Natural Resources Adaptation Subtotal	88	95	90	110	+15
Total-DOI	**147**	**153**	**145**	**182**	**+29**
Department of State					
Global Change Research Program					
Other-non-add	*3*	*3*	*3*	*3*	---
International Assistance					
Diplomatic and Consular Affairs	0	0	0	0	---
Economic Support Fund	96	96	91	94	-3
International Organizations and Programs	37	37	35	39	+2
State- International Assistance Subtotal	**133**	**132**	**126**	**133**	**+1**
Total-State	**133**	**132**	**126**	**133**	**+1**

Climate Change Expenditures by Agency	FY 2012 Enacted Budget Authority	FY 2013 Enacted Budget Authority	FY 2013 Current Budget Authority[2]	FY 2014 Proposed Budget Authority	Change in Budget Authority 2013-2014
Department of Transportation					
Global Change Research Program					
Federal Highway Administration – Federal-Aid Highways	0	0	0	0	---
Federal Aviation Administration – Research, Engineering, and Development	1	1	1	1	---
Federal Transit Administration - Research and University Research Centers	0	0	0	0	---
DOT- GCRP Subtotal	**1**	**1**	**1**	**1**	**---**
Clean Energy Technology					
National Highway Traffic Safety Administration	10	10	8	11	+1
Research and Innovative Technology Administration – Research and Development	1	1	1	1	---
Federal Aviation Administration - Research, Engineering, and Development	21	17	20	18	+1
Federal Aviation Administration -Facilities and Equipment	7	5	4	5	+1
Federal Transit Administration - Research and University Research Centers and Formula and Bus Grants	52	23	22	15	-8
Federal Railroad Association - Railroad Research and Development	1	2	1	3	+1
DOT- Clean Energy Subtotal	**91**	**57**	**56**	**52**	**-5**
Total-DOT	**92**	**58**	**57**	**53**	**-5**
Department of the Treasury					
International Assistance					
Debt Restructuring – Tropical Forestry Conservation	12	12	11	0	-12
Global Environment Facility	60	65	62	72	+7
Clean Technology Fund	230	185	175	216	+31
Strategic Climate Fund	75	50	47	68	+18
Total-Treasury	**377**	**311**	**296**	**356**	**+44**
Environmental Protection Agency					
Global Change Research Program					
Science and Technology	**18**	**19**	**17**	**20**	**+1**
Clean Energy Technology					
Environmental Programs and Management	99	99	95	106	+7
Science and Technology	18	17	16	10	-7
EPA-Clean Energy Subtotal	**117**	**116**	**111**	**115**	**---**

Climate Change Expenditures by Agency	**FY 2012 Enacted Budget Authority**	**FY 2013 Enacted Budget Authority**	**FY 2013 Current Budget Authority[2]**	**FY 2014 Proposed Budget Authority**	**Change in Budget Authority 2013-2014**
International Assistance					
Environmental Programs and Management	**18**	**18**	**16**	**19**	**---**
Adjustments for programs included in multiple categories -- EPA	*-9*	*-9*	*-7*	*-9*	---
Total-EPA	**144**	**144**	**137**	**145**	**+1**
Millennium Challenge Corporation					
International Assistance					
Millennium Challenge Corporation	**41**	**0**	**0**	**0**	**---**
Total-MCC	**41**	**0**	**0**	**0**	**---**
National Aeronautics and Space Administration					
Global Change Research Program					
Science	**1,390**	**1,444**	**1,428**	**1,493**	**+49**
Clean Energy Technology					
Aeronautics	259	262	255	284	+22
Exploration	9	7	6	9	+1
Space Technology	28	15	15	28	+14
NASA-Clean Energy Subtotal	**296**	**284**	**276**	**321**	**+37**
International Assistance					
Science	**3**	**3**	**3**	**3**	**---**
Adjustments for programs included in multiple categories -- NASA	*-3*	*-3*	*-3*	*-3*	---
Total-NASA	**1,686**	**1,728**	**1,704**	**1,814**	**+86**
National Science Foundation					
Global Change Research Program					
Research and Related Activities	**333**	**328**	**316**	**326**	**-2**
Clean Energy Technology					
Research and Related Activities	**341**	**352**	**346**	**372**	**+20**
International Assistance					
Research and Related Activities	**6**	**6**	**6**	**3**	**-3**
Total-NSF	**680**	**686**	**668**	**701**	**+15**

Climate Change Expenditures by Agency	**FY 2012 Enacted Budget Authority**	**FY 2013 Enacted Budget Authority**	**FY 2013 Current Budget Authority[2]**	**FY 2014 Proposed Budget Authority**	**Change in Budget Authority 2013-2014**
Nuclear Regulatory Commission					
Clean Energy Technology					
Salaries and Expenses	**83**	**82**	**57**	**86**	+4
Total- NRC	**83**	**82**	**57**	**86**	+4
Smithsonian Institution					
Global Change Research Program					
Salaries and Expenses	8	8	8	8	---
Total- Smithsonian	**8**	**8**	**8**	**8**	---
Tennessee Valley Authority					
Clean Energy Technology					
Tennessee Valley Authority Fund	**9**	**11**	**11**	**10**	-1
Total- TVA	**9**	**11**	**11**	**10**	-1
US Trade and Development Agency					
International Assistance					
Trade and Development Agency	**16**	**16**	**0**	**18**	**+1**
Total-TDA	**16**	**16**	**0**	**18**	**+1**
U.S. Agency for International Development					
Global Change Research Program					
Development Assistance-non-add	11	11	11	14	+3
International Assistance					
Assistance for Europe, Eurasia, and Central Asia	15	0	0	0	---
Development Assistance	322	322	308	317	-5
Economic Support Fund	12	28	27	32	+4
International Disaster Assistance	0	0	0	0	---
USAID-International Assistance Subtotal	**348**	**350**	**334**	**349**	**-1**
Total- USAID	**348**	**350**	**334**	**349**	**-1**

Climate Change Expenditures by Agency	FY 2012 Enacted Budget Authority	FY 2013 Enacted Budget Authority	FY 2013 Current Budget Authority[2]	FY 2014 Proposed Budget Authority	Change in Budget Authority 2013-2014
Total All Agencies[1]	**9,649**	**9,519**	**9,116**	**11,569**	**+2,051**
Energy Tax Provisions That May Reduce Greenhouse Gases	5,052	4,999	4,999	5,129	+130
Energy Payments in lieu of energy investment credit	5,080	8,080	8,080	4,710	-3,370
Total All Agencies + Tax Provisions	**19,781**	**22,598**	**22,195**	**21,408**	**-1,189**

Footnotes:

[1] Totals may not sum due to rounding.

[2] Current Budget Authority for FY 2013 throughout this document reflects the amount the program has available for the year calculated as the appropriated amount (as reported in the FY 2013 Enacted column) minus the reductions pursuant to the Budget Control Act of 2011 (P.L. 112-25) sequestration order issued on March 1, 2013, and accounting for any known and applicable reprogrammings, transfers, or other related adjustments. Estimates are current as of June 21, 2013 and are subject to change.

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEBRASKA

STATE OF NEBRASKA,	)	Case No. 4:14-cv-3006
	)	
Plaintiff,	)	
	)	**COMPLAINT FOR**
v.	)	**DECLARATORY AND**
	)	**INJUNCTIVE RELIEF**
UNITED STATES ENVIRONMENTAL	)	
PROTECTION AGENCY; and GINA	)	
McCARTHY, Administrator, U.S. EPA,	)	
	)	
Defendants.	)	

INTRODUCTION

1. On January 8, 2014, the United States Environmental Protection Agency ("EPA" or "Agency") published a proposed rule entitled "Standards of Performance for Greenhouse Gas Emissions From New Stationary Sources: Electric Utility Generating Units, Proposed Rule," 79 Fed. Reg. 1430 ("Proposed Rule"). The Proposed Rule purports to establish a new source standard of performance ("NSPS") for the emission of carbon dioxide ("CO_2") from new electric utility steam generating units ("EGUs"). See, 42 U.S.C. § 7411(b).

2. The State of Nebraska ("State") challenges the Proposed Rule as a violation of the Energy Policy Act of 2005 ("Act"), 42 U.S.C. §§ 15801 *et seq.*

3. Section 402(i) of Act provides that:

> No technology, or level of emission reduction, solely by reason of the use of the technology, or achievement of the emission reduction, by 1 or more facilities receiving assistance under this Act shall be considered to be adequately demonstrated for purposes of section 111 of the Clean Air Act.

42 U.S.C. § 15962(i).

4. The Proposed Rule, in contravention of these prohibitions, considers instances carbon capture and storage ("CCS") technology deployment financed with federal assistance under the Act to support the finding that CCS is "adequately demonstrated" for purposes of section 111 of the Clean Air Act ("CAA"), 42 U.S.C. § 7411.

5. The State challenges the Proposed Rule's consideration of these facilities' deployment of CCS as unlawful final agency action pursuant to the Administrative Procedure Act ("APA"). 5 U.S.C. §§ 701 *et seq.* The State seeks a declaration that the Proposed Rule's consideration of federally-financed CCS projects is "not in accordance with law" and "in excess of statutory . . . authority." 5 U.S.C. § 706(2)(A), (C). The State also requests injunctive relief, including an order from this Court directing EPA to cease further action on the NSPS rulemaking and withdraw the Proposed Rule.

JURISDICTION AND VENUE

6. The Court has jurisdiction over this action pursuant to 28 U.S.C. § 1331, because the States allege a violation of federal law; the APA, 5 U.S.C. §§ 701-706; and the Declaratory Judgment Act, 28 U.S.C. §§ 2201-2202, which provides for declaratory and other relief.

7. Venue is proper in this judicial district pursuant to 28 U.S.C. § 1391(e).

PARTIES

8. The Nebraska Department of Environmental Quality ("NDEQ") has assumed authority to implement and enforce many of the CAA permitting and standard-setting programs within its borders. In particular, the State implements an EPA-approved preconstruction permit program for major stationary sources under the CAA's Prevention of Significant Deterioration

("PSD") and nonattainment new source review ("NSR") provisions, for which NSPS serve as the baseline emission standard. See generally, 42 U.S.C. §§ 7470-7479; §§ 7501-7503. Furthermore, finalization of the Proposed Rule would arguably trigger the commencement of the rulemaking process for new source performance standards for existing electric utility generating units for which the State is primarily responsible. See, 42 U.S.C. § 7411(d).

9. The United States Environmental Protection Agency is the federal agency responsible for the implementing the CAA in cooperation with the State.

10. Gina McCarthy, Administrator of the EPA, is charged with the supervision and management of the Agency's responsibilities under the CAA. The State names Administrator McCarthy as Defendant in her official capacity only.

STATUTORY AND REGULATORY FRAMEWORK

I. Establishment of NSPS and Regulation of Stationary Sources under the CAA

11. The CAA authorizes regulation of emissions of air pollutants from new stationary sources which may reasonably be anticipated to endanger public health or welfare through the establishment of Federal performance standards, i.e. NSPS. See, 42 U.S.C. § 7411(b)(1)(B).

12. The NSPS for new stationary sources must be based on the "best system of emission reduction" that the "Administrator determines has been adequately demonstrated." 42 U.S.C. § 7411(a)(1).

13. The NSPS then serves as the baseline for the State when determining the appropriate emission standard representing the "best available control technology" to be included in permits issued under the CAA's PSD program. See, 42 U.S.C. § 7465(a)(4); see also, 42 U.S.C. § 7469(3). Similarly, the NSPS serves as the baseline for the State when determining the

appropriate emission standard representing the "lowest achievable emission rate" to be included in permits issued under the CAA's NSR program. See, 42 U.S.C. § 7503(a)(2); 42 U.S.C. § 7501(3).

II. The Energy Policy Act of 2005

14. The Clean Coal Power Initiative ("CCPI") was established in 2002 as a partnership between government and industry, with a focus on implementing the President's National Energy Policy recommendation to increase investment in clean coal technology. See, "Notice of Intent to Prepare an Environmental Impact Statement and Notice of Proposed Floodplain and Wetlands Involvement for the Kemper County IGCC Project, Kemper County, MS," 73 Fed. Reg. 54,570 (September 22, 2008).

15. On August 8, 2005, the CCPI was codified as part of the Energy Policy Act of 2005. Pub. L. 109-58. Title IV of the Act addresses development of coal resources. Subtitle A of that Title, which codifies the CCPI, authorizes the appropriation of funds to the Secretary of Energy to assist projects seeking to "advance efficiency, environmental performance, and cost competitiveness." See, 42 U.S.C. §§ 15961 (a); 15962(a).

16. Section 402 specifies that in order "to be eligible to receive assistance" under the CCPI a project must "advance efficiency, environmental performance, and cost competitiveness well beyond the level of technologies" that are currently in "commercial service" or which have been "demonstrated on a scale that the Secretary [of DOE] determines is sufficient to demonstrate that commercial service is viable as of the date of enactment" of the Energy Policy Act. 42 U.S.C. § 15962(a).

17. The Act's objective of financing and developing only those projects seeking to achieve a level of efficiency, environmental performance, and cost-competitiveness beyond that

achieved by current, commercially available and demonstrated technologies is supported by the protection provided against premature regulatory mandates based on such projects:

> (i) Applicability.–No technology, or level of emission reduction, solely by reason of the use of the technology, or achievement of the emission reduction, by 1 or more facilities receiving assistance under this Act, shall be considered to be–
>
> (1) adequately demonstrated for purposes of section 111 of the Clean Air Act (42 U.S.C. 7411);
>
> (2) achievable for purposes of section 169 of that Act (42 U.S.C. 7479); or
>
> (3) achievable in practice for purposes of section 171 of that Act (42 U.S.C. 7501).

42 U.S.C. § 15962(i).

III. The Proposed Rule

18. The Proposed Rule would establish an emission limit of 1,100 pounds of CO_2 per megawatt hour ("MWh") for utility boilers and Integrated Gasification Combined Cycle units based on partial implementation of carbon capture and storage ("CCS") as the "best system of emission reduction". 79 Fed. Reg. 1430, 1433. EPA states it considered the expected performance of the CCS technology at a number of facilities, including the Kemper County Energy Facility ("Kemper"), Texas Clean Energy Project ("TCEP"), and Hydrogen Energy California ("HECA") facilities, in finding that CCS is "adequately demonstrated." See, e.g., 79 Fed. Reg. 1434 ("The existence and apparent ongoing viability of these projects which include CCS justify a separate BSER determination for new fossil fuel-fired utility boilers and IGCC power plants."); see also 79 Fed. Reg. at 1478 (a "segment of the industry consists of the several coal-fired EGU projects that already incorporate at least partial CCS. These projects, which are each progressing, include Kemper, TCEP, and HECA."); see also, 79 Fed. Reg. at 1479 ("additional knowledge will be gained from deployment and operation of at least two new coal-

fired generation projects that include CCS...Kemper County Energy Facility IGCC with CCS and the Boundry Dam CCS project on a conventional coal-fired power plant in Canada."); see also, 79 Fed. Reg. at 1482 ("EPA expect that for the immediate future, captured CO_2 from affected units will be injected underground for geologic sequestration at sites where EOR ("enhanced oil recovery") is occurring....Three solid-fuel fired EGU projects incorporating CCS – Kemper, TCEP, and HECA – all include utilization of captured CO_2 for EOR.") (parenthetical supplied).

19. The Proposed Rule does not attempt to resolve the inconsistency with the Act's prohibition against premature regulatory mandates based on the consideration of technology deployment at facilities receiving assistance under the Act. Rather, the Proposed Rule seeks to circumvent the Act's prohibition by arguing that "many types of electricity generation receive government subsidies." 79 Fed. Reg. at 1478. Indeed the Proposed Rule acknowledges that "[i]t is true that each of these projects has received DOE grants to encourage the development of CCS technology, but we do not consider such government subsidies to mean that the costs of CCS would otherwise be unreasonable." 79 Fed. Reg. at 1478.

FACTUAL BACKGROUND

I. The Kemper Facility

20. The Kemper facility currently under construction is a 582-megawatt power plant that will utilize CCS technology. Kemper is located approximately 30 miles north of Meridian, Mississippi. It will be owned and operated by Mississippi Power. By design, Kemper will have an advanced gasification plant and a combined cycle plant working together. This process sends coal through a device called a gasifier. By being subjected to high

temperatures and high pressure, the coal undergoes a chemical reaction that creates a synthesis gas. The cleaned "syngas" is then used in a gas turbine to generate power. Up to 65 percent of the CO_2 from the Kemper Facility will be captured and sold for enhanced oil recovery ("EOR"). CO_2 injection is a common method of EOR, in which the CO_2 is injected into abandoned oil wells to force oil out of the ground.

21. Kemper has received grants totaling some $270 million from the DOE and more than $400 million in investment tax credits approved by the United States Internal Revenue Service ("IRS") through the Energy Policy Act of 2005.

II. The TCEP Facility

22. The planned TCEP facility is a 400-megawatt power plant that will utilize CCS technology. TCEP will be located approximately 15 miles west of Odessa, Texas. The project is being developed by Summit Power Group, Inc. TCEP is designed to have a carbon capture rate of 90 percent, with the captured CO_2 being used for EOR in the West Texas Permian Basin.

23. TCEP has received grants totaling some $450 million from DOE and over $600 million in investment tax credits approved by the IRS through the Energy Policy Act of 2005.

III. The HECA Facility

24. The planned HECA facility is a 300-megawatt power plant that will utilize CCS technology. HECA will be located approximately 21 miles west of Bakersfield, California. The project is being developed by SCS Energy. HECA will convert coal, petroleum coke and brackish water into liquefied hydrogen and CO_2. HECA is designed to have a carbon capture rate of 90 percent, with the captured CO_2 being used for EOR in the Elk Hills oil field.

25. HECA has received grants totaling some $400 million from DOE and over $400 million in investment tax credits approved by the IRS through the Energy Policy Act of 2005.

26. To date, the facilities considered by the Proposed Rule – Kemper, TCEP, and HECA – have received a combined $2,520,000,000.00 in federal subsidies.

CLAIM FOR RELIEF

27. The State incorporates all allegations set forth above by reference.

28. The State is entitled to judicial review under the APA. See, 5 U.S.C. §§ 702, 704 (providing judicial review to "[a] person suffering legal wrong because of agency action, or adversely affected or aggrieved by agency action," where such action is "final" and for which there is "no other adequate remedy in a court.").

29. Pursuant to the APA the Court "shall . . . hold unlawful and set aside agency action, findings, and conclusions . . . not in accordance with law" or "in excess of statutory . . . authority." 5 U.S.C. § 706(2)(A), (C).

30. The Proposed Rule's consideration of the use of CCS technology at such facilities as the Kemper, TCEP, and HECA facilities, is "not in accordance with law" and is "in excess of statutory . . . authority," as the Agency's consideration of those facilities violates section 402(i) of the Energy Policy Act. 42 U.S.C. § 15962(i).

PRAYER FOR RELIEF

The State respectfully requests that the Court enter judgment:

1. Declaring that the Proposed Rule violates the Energy Policy Act of 2005 by considering the use of CCS technology at the Kemper, TCEP, and HECA facilities and basing its finding that CCS is the "best system of emission reduction" that is "adequately demonstrated" for purposes of 42 U.S.C. § 7411 on such considerations;

2. Ordering Defendants to withdraw the Proposed Rule;

3. Enjoining EPA from future consideration the use of CCS technology at the Kemper, TCEP, and HECA facilities as a basis for finding that CCS is the "best system of emission reduction" that is "adequately demonstrated" for purposes of 42 U.S.C. §7411 on such considerations; and

4. Granting the State such additional relief as the Court deems appropriate.

Respectfully submitted this 15th day of January 2014.

STATE OF NEBRASKA,
Plaintiff

BY: JON BRUNING, #20351
ATTORNEY GENERAL

BY: */s/ Katherine J. Spohn*
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CHIEF DEPUTY ATTORNEY GENERAL
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EXTENSION GRANTED

Form **990-PF**
Department of the Treasury
Internal Revenue Service

Return of Private Foundation
or Section 4947(a)(1) Nonexempt Charitable Trust
Treated as a Private Foundation

Note. The foundation may be able to use a copy of this return to satisfy state reporting requirements

OMB No 1545-0052

2011

For calendar year 2011 or tax year beginning , 2011, and ending , 20

Name of foundation
CHARLES KOCH FOUNDATION

Number and street (or P O box number if mail is not delivered to street address) Room/suite
P.O. BOX 2256

City or town, state, and ZIP code
WICHITA, KS 67201-2256

A Employer identification number
48-0918408

B Telephone number (see instructions)
(316) 828-8286

C If exemption application is pending, check here ▶ ☐

D 1 Foreign organizations, check here ▶ ☐
2 Foreign organizations meeting the 85% test, check here and attach computation ▶ ☐

E If private foundation status was terminated under section 507(b)(1)(A), check here ▶ ☐

F If the foundation is in a 60-month termination under section 507(b)(1)(B), check here ▶ ☐

G Check all that apply ☐ Initial return ☐ Initial return of a former public charity
☐ Final return ☐ Amended return
☐ Address change ☒ Name change

H Check type of organization ☒ Section 501(c)(3) exempt private foundation
☐ Section 4947(a)(1) nonexempt charitable trust ☐ Other taxable private foundation

I Fair market value of all assets at end of year *(from Part II, col (c), line 16)* ▶ $ 214,087,257.

J Accounting method ☐ Cash ☒ Accrual
☐ Other (specify) ____________
(Part I, column (d) must be on cash basis)

Part I **Analysis of Revenue and Expenses** *(The total of amounts in columns (b), (c), and (d) may not necessarily equal the amounts in column (a) (see instructions))*

			(a) Revenue and expenses per books	(b) Net investment income	(c) Adjusted net income	(d) Disbursements for charitable purposes (cash basis only)
Revenue	1	Contributions, gifts, grants etc received (attach schedule)	26,427.			
	2	Check ▶ ☐ if the foundation is not required to attach Sch B				
	3	Interest on savings and temporary cash investments	92,590.	92,590.		
	4	Dividends and interest from securities	3,462,155.	3,462,155.		
	5a	Gross rents				
	b	Net rental income or (loss)				
	6a	Net gain or (loss) from sale of assets not on line 10	2,545,112.			
	b	Gross sales price for all assets on line 6a 52,662,668.				
	7	Capital gain net income (from Part IV, line 2)		2,545,112.		
	8	Net short-term capital gain			0	
	9	Income modifications				
	10a	Gross sales less returns and allowances				
	b	Less Cost of goods sold				
	c	Gross profit or (loss) (attach schedule)				
	11	Other income (attach schedule)	19,384.	360.		ATCH 1
	12	**Total.** Add lines 1 through 11	6,145,668.	6,100,217.	0	
Operating and Administrative Expenses	13	Compensation of officers, directors, trustees, etc	0			
	14	Other employee salaries and wages	3,495,632.			3,495,632.
	15	Pension plans, employee benefits	696,080.			696,080.
	16a	Legal fees (attach schedule) ATCH 2	22,393.			22,393.
	b	Accounting fees (attach schedule) ATCH 3	138,623.	2,601.		142,697.
	c	Other professional fees (attach schedule) *	1,681,810.	331,816.		1,365,526.
	17	Interest				
	18	Taxes (attach schedule) (see instructions) **	136,108.	73.		20,720.
	19	Depreciation (attach schedule) and depletion	274,429.			
	20	Occupancy	870,711.			870,711.
	21	Travel, conferences, and meetings	506,413.			506,733.
	22	Printing and publications	114,779.			114,779.
	23	Other expenses (attach schedule) ATCH 6	539,330.			539,330.
	24	**Total operating and administrative expenses.** Add lines 13 through 23	8,476,308.	334,490.		7,774,601.
	25	Contributions, gifts, grants paid	15,990,525.			13,160,919.
	26	**Total expenses and disbursements** Add lines 24 and 25	24,466,833.	334,490.	0	20,935,520.
	27	Subtract line 26 from line 12				
	a	**Excess of revenue over expenses and disbursements**	-18,321,165.			
	b	**Net investment income** (if negative, enter -0-)		5,765,727.		
	c	**Adjusted net income** (if negative, enter -0-)			0	

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For Paperwork Reduction Act Notice, see instructions. *ATCH 4 JSA ** ATCH 5 Form **990-PF** (2011)

Part II		**Balance Sheets** Attached schedules and amounts in the description column should be for end-of-year amounts only (See instructions)	Beginning of year	End of year	
			(a) Book Value	(b) Book Value	(c) Fair Market Value
Assets	1	Cash - non-interest-bearing	77,842.	676,259.	676,259.
	2	Savings and temporary cash investments	112,132,186.	8,655,461.	8,655,461.
	3	Accounts receivable ▶ 87,889. Less: allowance for doubtful accounts ▶	223,531.	87,889.	87,889.
	4	Pledges receivable ▶ Less: allowance for doubtful accounts ▶			
	5	Grants receivable			
	6	Receivables due from officers, directors, trustees, and other disqualified persons (attach schedule) (see instructions)			
	7	Other notes and loans receivable (attach schedule) ▶ Less allowance for doubtful accounts ▶			
	8	Inventories for sale or use			
	9	Prepaid expenses and deferred charges	68,384.	113,397.	113,397.
	10 a	Investments - U S and state government obligations (attach schedule)			
	b	Investments - corporate stock (attach schedule)			
	c	Investments - corporate bonds (attach schedule)			
	11	Investments - land, buildings, and equipment basis ▶ 3,377,694. Less accumulated depreciation (attach schedule) ▶	3,377,694.	3,377,694.	ATCH 7 2,455,694.
	12	Investments - mortgage loans			
	13	Investments - other (attach schedule) ATCH 8	117,935,513.	203,038,442.	201,693,326.
	14	Land, buildings, and equipment basis ▶ 1,020,219. Less accumulated depreciation (attach schedule) ▶ 614,988.	1,042,504.	405,231.	ATCH 9 405,231.
	15	Other assets (describe ▶)			
	16	**Total assets** (to be completed by all filers - see the instructions Also, see page 1, item I)	234,857,654.	216,354,373.	214,087,257.
Liabilities	17	Accounts payable and accrued expenses	29,937.	18,746.	
	18	Grants payable	3,034,871.	2,863,946.	
	19	Deferred revenue			
	20	Loans from officers, directors, trustees, and other disqualified persons			
	21	Mortgages and other notes payable (attach schedule)			
	22	Other liabilities (describe ▶)			
	23	**Total liabilities** (add lines 17 through 22)	3,064,808.	2,882,692.	
Net Assets or Fund Balances		**Foundations that follow SFAS 117, check here ▶ ☒ and complete lines 24 through 26 and lines 30 and 31.**			
	24	Unrestricted	231,792,846.	213,471,681.	
	25	Temporarily restricted			
	26	Permanently restricted			
		Foundations that do not follow SFAS 117, check here and complete lines 27 through 31. ▶ ☐			
	27	Capital stock, trust principal, or current funds			
	28	Paid-in or capital surplus, or land, bldg , and equipment fund			
	29	Retained earnings, accumulated income, endowment, or other funds			
	30	**Total net assets or fund balances** (see instructions)	231,792,846.	213,471,681.	
	31	**Total liabilities and net assets/fund balances** (see instructions)	234,857,654.	216,354,373.	

Part III Analysis of Changes in Net Assets or Fund Balances

1	Total net assets or fund balances at beginning of year - Part II, column (a), line 30 (must agree with end-of-year figure reported on prior year's return)	1	231,792,846.
2	Enter amount from Part I, line 27a	2	-18,321,165.
3	Other increases not included in line 2 (itemize) ▶	3	
4	Add lines 1, 2, and 3	4	213,471,681.
5	Decreases not included in line 2 (itemize) ▶	5	
6	Total net assets or fund balances at end of year (line 4 minus line 5) - Part II, column (b), line 30	6	213,471,681.

Part IV Capital Gains and Losses for Tax on Investment Income

	(a) List and describe the kind(s) of property sold (e g , real estate, 2-story brick warehouse, or common stock, 200 shs MLC Co)	(b) How acquired P-Purchase D-Donation	(c) Date acquired (mo , day, yr)	(d) Date sold (mo , day, yr)
1a	SEE PART IV SCHEDULE			
b				
c				
d				
e				

	(e) Gross sales price	(f) Depreciation allowed (or allowable)	(g) Cost or other basis plus expense of sale	(h) Gain or (loss) (e) plus (f) minus (g)
a				
b				
c				
d				
e				

Complete only for assets showing gain in column (h) and owned by the foundation on 12/31/69

	(i) F M V as of 12/31/69	(j) Adjusted basis as of 12/31/69	(k) Excess of col (i) over col (j), if any	(l) Gains (Col (h) gain minus col (k), but not less than -0-) or Losses (from col (h))
a				
b				
c				
d				
e				

2 Capital gain net income or (net capital loss) { If gain, also enter in Part I, line 7 / If (loss), enter -0- in Part I, line 7 } 2 2,545,112.

3 Net short-term capital gain or (loss) as defined in sections 1222(5) and (6)
If gain, also enter in Part I, line 8, column (c) (see instructions) If (loss), enter -0- in Part I, line 8 3 0

Part V Qualification Under Section 4940(e) for Reduced Tax on Net Investment Income

(For optional use by domestic private foundations subject to the section 4940(a) tax on net investment income)

If section 4940(d)(2) applies, leave this part blank

Was the foundation liable for the section 4942 tax on the distributable amount of any year in the base period? ☐ Yes ☒ No
If "Yes," the foundation does not qualify under section 4940(e) Do not complete this part

1 Enter the appropriate amount in each column for each year, see the instructions before making any entries

(a) Base period years Calendar year (or tax year beginning in)	(b) Adjusted qualifying distributions	(c) Net value of noncharitable-use assets	(d) Distribution ratio (col (b) divided by col (c))
2010	18,901,264.	203,468,683.	0.092895
2009	19,551,962.	155,141,798.	0.126026
2008	15,476,965.	170,704,588.	0.090665
2007	10,080,287.	127,673,989.	0.078953
2006	8,276,208.	76,656,070.	0.107965

2	**Total** of line 1, column (d)	2	0.496504
3	Average distribution ratio for the 5-year base period - divide the total on line 2 by 5, or by the number of years the foundation has been in existence if less than 5 years	3	0.099301
4	Enter the net value of noncharitable-use assets for 2011 from Part X, line 5	4	215,815,197.
5	Multiply line 4 by line 3	5	21,430,665.
6	Enter 1% of net investment income (1% of Part I, line 27b)	6	57,657.
7	Add lines 5 and 6	7	21,488,322.
8	Enter qualifying distributions from Part XII, line 4	8	20,955,082.

If line 8 is equal to or greater than line 7, check the box in Part VI, line 1b, and complete that part using a 1% tax rate. See the Part VI instructions

Part VI Excise Tax Based on Investment Income (Section 4940(a), 4940(b), 4940(e), or 4948 - see instructions)

1a	Exempt operating foundations described in section 4940(d)(2), check here ▶ ☐ and enter "N/A" on line 1 . . . Date of ruling or determination letter _______________ (attach copy of letter if necessary - see instructions)				
b	Domestic foundations that meet the section 4940(e) requirements in Part V, check here ▶ ☐ and enter 1% of Part I, line 27b . . .			1	115,315.
c	All other domestic foundations enter 2% of line 27b Exempt foreign organizations enter 4% of Part I, line 12, col (b)				
2	Tax under section 511 (domestic section 4947(a)(1) trusts and taxable foundations only Others enter -0-) . . .			2	
3	Add lines 1 and 2 . . .			3	115,315.
4	Subtitle A (income) tax (domestic section 4947(a)(1) trusts and taxable foundations only Others enter -0-) . . .			4	0
5	**Tax based on investment income.** Subtract line 4 from line 3 If zero or less, enter -0- . . .			5	115,315.
6	Credits/Payments:				
a	2011 estimated tax payments and 2010 overpayment credited to 2011 . . .	6a	150,834.		
b	Exempt foreign organizations - tax withheld at source . . .	6b			
c	Tax paid with application for extension of time to file (Form 8868) . . .	6c			
d	Backup withholding erroneously withheld . . .	6d			
7	Total credits and payments Add lines 6a through 6d . . .			7	150,834.
8	Enter any **penalty** for underpayment of estimated tax. Check here ☐ if Form 2220 is attached . . .			8	
9	**Tax due.** If the total of lines 5 and 8 is more than line 7, enter **amount owed** . . . ▶			9	
10	**Overpayment.** If line 7 is more than the total of lines 5 and 8, enter the **amount overpaid** . . . ▶			10	35,519.
11	Enter the amount of line 10 to be **Credited to 2012 estimated tax** ▶ 35,519. **Refunded** ▶			11	

Part VII-A Statements Regarding Activities

			Yes	No
1a	During the tax year, did the foundation attempt to influence any national, state, or local legislation or did it participate or intervene in any political campaign? . . .	1a		X
b	Did it spend more than $100 during the year (either directly or indirectly) for political purposes (see page 19 of the instructions for definition)? . . .	1b		X
	If the answer is "Yes" to 1a or 1b, attach a detailed description of the activities and copies of any materials published or distributed by the foundation in connection with the activities			
c	Did the foundation file **Form 1120-POL** for this year? . . .	1c		X
d	Enter the amount (if any) of tax on political expenditures (section 4955) imposed during the year (1) On the foundation ▶ $ ____________ (2) On foundation managers ▶ $ ____________			
e	Enter the reimbursement (if any) paid by the foundation during the year for political expenditure tax imposed on foundation managers ▶ $ ____________			
2	Has the foundation engaged in any activities that have not previously been reported to the IRS? . . . *If "Yes," attach a detailed description of the activities*	2		X
3	Has the foundation made any changes, not previously reported to the IRS, in its governing instrument, articles of incorporation, or bylaws, or other similar instruments? *If "Yes," attach a conformed copy of the changes* . . .	3		X
4a	Did the foundation have unrelated business gross income of $1,000 or more during the year? . . .	4a		X
b	If "Yes," has it filed a tax return on **Form 990-T** for this year? . . .	4b		
5	Was there a liquidation, termination, dissolution, or substantial contraction during the year? . . . *If "Yes," attach the statement required by General Instruction T*	5		X
6	Are the requirements of section 508(e) (relating to sections 4941 through 4945) satisfied either • By language in the governing instrument, or • By state legislation that effectively amends the governing instrument so that no mandatory directions that conflict with the state law remain in the governing instrument? . . .	6	X	
7	Did the foundation have at least $5,000 in assets at any time during the year? *If "Yes," complete Part II, col (c), and Part XV*	7	X	
8a	Enter the states to which the foundation reports or with which it is registered (see instructions) ▶ DC, KS, VA,			
b	If the answer is "Yes" to line 7, has the foundation furnished a copy of Form 990-PF to the Attorney General (or designate) of each state as required by *General Instruction G? If "No," attach explanation* . . .	8b	X	
9	Is the foundation claiming status as a private operating foundation within the meaning of section 4942(j)(3) or 4942(j)(5) for calendar year 2011 or the taxable year beginning in 2011 (see instructions for Part XIV)? *If "Yes," complete Part XIV* . . .	9		X
10	Did any persons become substantial contributors during the tax year? *If "Yes," attach a schedule listing their names and addresses* . . .	10		X

Part VII-A Statements Regarding Activities *(continued)*

			Yes	No
11	At any time during the year, did the foundation, directly or indirectly, own a controlled entity within the meaning of section 512(b)(13)? If "Yes," attach schedule (see instructions)	11		X
12	Did the foundation make a distribution to a donor advised fund over which the foundation or a disqualified person had advisory privileges? If "Yes," attach statement (see instructions)	12		X
13	Did the foundation comply with the public inspection requirements for its annual returns and exemption application?	13	X	

Website address ▶ WWW.CHARLESKOCHFOUNDATION.ORG

14 The books are in care of ▶ HEATHER LOVE Telephone no ▶ (316)828-8286

Located at ▶ 4111 E. 37TH ST. N. WICHITA, KS ZIP + 4 ▶ 67220

15 Section 4947(a)(1) nonexempt charitable trusts filing Form 990-PF in lieu of **Form 1041** - Check here ▶ ☐

and enter the amount of tax-exempt interest received or accrued during the year ▶ 15

			Yes	No
16	At any time during calendar year 2011, did the foundation have an interest in or a signature or other authority over a bank, securities, or other financial account in a foreign country?	16		X
	See the instructions for exceptions and filing requirements for Form TD F 90-22 1 If "Yes," enter the name of the foreign country ▶			

Part VII-B Statements Regarding Activities for Which Form 4720 May Be Required

			Yes	No
	File Form 4720 if any item is checked in the "Yes" column, unless an exception applies.			
1a	During the year did the foundation (either directly or indirectly)			
	(1) Engage in the sale or exchange, or leasing of property with a disqualified person? ☐ Yes ☒ No			
	(2) Borrow money from, lend money to, or otherwise extend credit to (or accept it from) a disqualified person? ☐ Yes ☒ No			
	(3) Furnish goods, services, or facilities to (or accept them from) a disqualified person? ☒ Yes ☐ No			
	(4) Pay compensation to, or pay or reimburse the expenses of, a disqualified person? ☒ Yes ☐ No			
	(5) Transfer any income or assets to a disqualified person (or make any of either available for the benefit or use of a disqualified person)? ☐ Yes ☒ No			
	(6) Agree to pay money or property to a government official? (**Exception.** Check "No" if the foundation agreed to make a grant to or to employ the official for a period after termination of government service, if terminating within 90 days.) ☐ Yes ☒ No			
b	If any answer is "Yes" to 1a(1)-(6), did any of the acts fail to qualify under the exceptions described in Regulations section 53 4941(d)-3 or in a current notice regarding disaster assistance (see instructions)?	1b		X
	Organizations relying on a current notice regarding disaster assistance check here ▶ ☐			
c	Did the foundation engage in a prior year in any of the acts described in 1a, other than excepted acts, that were not corrected before the first day of the tax year beginning in 2011?	1c		X
2	Taxes on failure to distribute income (section 4942) (does not apply for years the foundation was a private operating foundation defined in section 4942(j)(3) or 4942(j)(5))			
a	At the end of tax year 2011, did the foundation have any undistributed income (lines 6d and 6e, Part XIII) for tax year(s) beginning before 2011? ☐ Yes ☒ No If "Yes," list the years ▶			
b	Are there any years listed in 2a for which the foundation is **not** applying the provisions of section 4942(a)(2) (relating to incorrect valuation of assets) to the year's undistributed income? (If applying section 4942(a)(2) to all years listed, answer "No" and attach statement - see instructions.)	2b		
c	If the provisions of section 4942(a)(2) are being applied to any of the years listed in 2a, list the years here ▶			
3a	Did the foundation hold more than a 2% direct or indirect interest in any business enterprise at any time during the year? ☐ Yes ☒ No			
b	If "Yes," did it have excess business holdings in 2011 as a result of (1) any purchase by the foundation or disqualified persons after May 26, 1969, (2) the lapse of the 5-year period (or longer period approved by the Commissioner under section 4943(c)(7)) to dispose of holdings acquired by gift or bequest, or (3) the lapse of the 10-, 15-, or 20-year first phase holding period? *(Use Schedule C, Form 4720, to determine if the foundation had excess business holdings in 2011.)*	3b		
4a	Did the foundation invest during the year any amount in a manner that would jeopardize its charitable purposes?	4a		X
b	Did the foundation make any investment in a prior year (but after December 31, 1969) that could jeopardize its charitable purpose that had not been removed from jeopardy before the first day of the tax year beginning in 2011?	4b		X

Part VII-B Statements Regarding Activities for Which Form 4720 May Be Required *(continued)*

5a During the year did the foundation pay or incur any amount to

(1) Carry on propaganda, or otherwise attempt to influence legislation (section 4945(e))? . . . . . . ☐ Yes ☒ No

(2) Influence the outcome of any specific public election (see section 4955), or to carry on, directly or indirectly, any voter registration drive? . . . . ☐ Yes ☒ No

(3) Provide a grant to an individual for travel, study, or other similar purposes? . . . . ☐ Yes ☒ No

(4) Provide a grant to an organization other than a charitable, etc., organization described in section 509(a)(1), (2), or (3), or section 4940(d)(2)? (see instructions) . . . . ☒ Yes ☐ No

(5) Provide for any purpose other than religious, charitable, scientific, literary, or educational purposes, or for the prevention of cruelty to children or animals? . . . . ☐ Yes ☒ No

b If any answer is "Yes" to 5a(1)-(5), did any of the transactions fail to qualify under the exceptions described in Regulations section 53.4945 or in a current notice regarding disaster assistance (see instructions)? . . . . **5b** X

Organizations relying on a current notice regarding disaster assistance check here . . . . ▶ ☐

c If the answer is "Yes" to question 5a(4), does the foundation claim exemption from the tax because it maintained expenditure responsibility for the grant? . . ATTACHMENT 10 . . . . ☒ Yes ☐ No

If "Yes," attach the statement required by Regulations section 53.4945-5(d)

6a Did the foundation, during the year, receive any funds, directly or indirectly, to pay premiums on a personal benefit contract? . . . . ☐ Yes ☒ No

b Did the foundation, during the year, pay premiums, directly or indirectly, on a personal benefit contract? . . . . **6b** X

If "Yes" to 6b, file Form 8870

7a At any time during the tax year, was the foundation a party to a prohibited tax shelter transaction? . . ☐ Yes ☒ No

b If "Yes," did the foundation receive any proceeds or have any net income attributable to the transaction? **7b**

Part VIII Information About Officers, Directors, Trustees, Foundation Managers, Highly Paid Employees, and Contractors

1 List all officers, directors, trustees, foundation managers and their compensation (see instructions).

(a) Name and address	(b) Title, and average hours per week devoted to position	(c) Compensation (If not paid, enter -0-)	(d) Contributions to employee benefit plans and deferred compensation	(e) Expense account, other allowances
ATTACHMENT 11		0	0	0

2 Compensation of five highest-paid employees (other than those included on line 1 - see instructions). If none, enter "NONE."

(a) Name and address of each employee paid more than $50,000	(b) Title, and average hours per week devoted to position	(c) Compensation	(d) Contributions to employee benefit plans and deferred compensation	(e) Expense account, other allowances
ATTACHMENT 12		640,366.	25,349.	6,480.

Total number of other employees paid over $50,000 . . . . ▶ 12

Form **990-PF** (2011)

Part VIII Information About Officers, Directors, Trustees, Foundation Managers, Highly Paid Employees, and Contractors *(continued)*

3 Five highest-paid independent contractors for professional services (see instructions). If none, enter "NONE."

(a) Name and address of each person paid more than $50,000	(b) Type of service	(c) Compensation
KOCH INDUSTRIES INC. WICHITA, KS 67201	ACCTG/FINANCE SRVC	132,750.
FP1 STRATEGIES ALEXANDRIA, VA 22201	PROF. CONSULT. SVCS	70,000.

Total number of others receiving over $50,000 for professional services . . . . ▶ 0

Part IX-A Summary of Direct Charitable Activities

List the foundation's four largest direct charitable activities during the tax year Include relevant statistical information such as the number of organizations and other beneficiaries served, conferences convened, research papers produced, etc	Expenses
1 KOCH ASSOCIATES PROGRAM: SEE GENERAL EXPLANATION ATTACHMENT	2,048,905.
2 KOCH INTERNSHIP PROGRAM: SEE GENERAL EXPLANATION ATTACHMENT	682,752.
3 LIBERTY @ WORK PROGRAM: SEE GENERAL EXPLANATION ATTACHMENT	320,514.
4	

Part IX-B Summary of Program-Related Investments (see instructions)

Describe the two largest program-related investments made by the foundation during the tax year on lines 1 and 2	Amount
1 NONE	
2	
All other program-related investments See instructions 3 NONE	
Total. Add lines 1 through 3 . . . . ▶	

Part X **Minimum Investment Return** (All domestic foundations must complete this part. Foreign foundations, see instructions.)

1	Fair market value of assets not used (or held for use) directly in carrying out charitable, etc, purposes				
a	Average monthly fair market value of securities			1a	167,462,872.
b	Average of monthly cash balances			1b	48,991,074.
c	Fair market value of all other assets (see instructions)			1c	2,647,777.
d	**Total** (add lines 1a, b, and c)			1d	219,101,723.
e	Reduction claimed for blockage or other factors reported on lines 1a and 1c (attach detailed explanation)	1e			
2	Acquisition indebtedness applicable to line 1 assets			2	
3	Subtract line 2 from line 1d			3	219,101,723.
4	Cash deemed held for charitable activities Enter 1 1/2% of line 3 (for greater amount, see instructions)			4	3,286,526.
5	**Net value of noncharitable-use assets.** Subtract line 4 from line 3 Enter here and on Part V, line 4			5	215,815,197.
6	**Minimum investment return.** Enter 5% of line 5			6	10,790,760.

Part XI **Distributable Amount** (see instructions) (Section 4942(j)(3) and (j)(5) private operating foundations and certain foreign organizations check here ▶ ☐ and do not complete this part)

1	Minimum investment return from Part X, line 6			1	10,790,760.
2a	Tax on investment income for 2011 from Part VI, line 5	2a	115,315.		
b	Income tax for 2011 (This does not include the tax from Part VI)	2b			
c	Add lines 2a and 2b			2c	115,315.
3	Distributable amount before adjustments Subtract line 2c from line 1			3	10,675,445.
4	Recoveries of amounts treated as qualifying distributions			4	
5	Add lines 3 and 4			5	10,675,445.
6	Deduction from distributable amount (see instructions)			6	
7	**Distributable amount** as adjusted Subtract line 6 from line 5 Enter here and on Part XIII, line 1			7	10,675,445.

Part XII **Qualifying Distributions** (see instructions)

1	Amounts paid (including administrative expenses) to accomplish charitable, etc , purposes		
a	Expenses, contributions, gifts, etc - total from Part I, column (d), line 26	1a	20,935,520.
b	Program-related investments - total from Part IX-B	1b	
2	Amounts paid to acquire assets used (or held for use) directly in carrying out charitable, etc, purposes	2	19,562.
3	Amounts set aside for specific charitable projects that satisfy the		
a	Suitability test (prior IRS approval required)	3a	
b	Cash distribution test (attach the required schedule)	3b	
4	**Qualifying distributions.** Add lines 1a through 3b Enter here and on Part V, line 8, and Part XIII, line 4	4	20,955,082.
5	Foundations that qualify under section 4940(e) for the reduced rate of tax on net investment income Enter 1% of Part I, line 27b (see instructions)	5	0
6	**Adjusted qualifying distributions.** Subtract line 5 from line 4	6	20,955,082.

Note. The amount on line 6 will be used in Part V, column (b), in subsequent years when calculating whether the foundation qualifies for the section 4940(e) reduction of tax in those years

Part XIII Undistributed Income (see instructions)

			(a) Corpus	(b) Years prior to 2010	(c) 2010	(d) 2011
1	Distributable amount for 2011 from Part XI, line 7					10,675,445.
2	Undistributed income, if any, as of the end of 2011					
a	Enter amount for 2010 only					
b	Total for prior years 20 09 ,20 08 ,20 07					
3	Excess distributions carryover, if any, to 2011:					
a	From 2006	4,479,130.				
b	From 2007	3,779,603.				
c	From 2008	7,054,261.				
d	From 2009	11,912,574.				
e	From 2010	8,931,145.				
f	**Total** of lines 3a through e		36,156,713.			
4	Qualifying distributions for 2011 from Part XII, line 4: ▶ $ 20,955,082.					
a	Applied to 2010, but not more than line 2a					
b	Applied to undistributed income of prior years (Election required - see instructions)					
c	Treated as distributions out of corpus (Election required - see instructions)					
d	Applied to 2011 distributable amount					10,675,445.
e	Remaining amount distributed out of corpus		10,279,637.			
5	Excess distributions carryover applied to 2011 *(If an amount appears in column (d), the same amount must be shown in column (a).)*					
6	**Enter the net total of each column as indicated below:**					
a	Corpus Add lines 3f, 4c, and 4e Subtract line 5		46,436,350.			
b	Prior years' undistributed income Subtract line 4b from line 2b					
c	Enter the amount of prior years' undistributed income for which a notice of deficiency has been issued, or on which the section 4942(a) tax has been previously assessed					
d	Subtract line 6c from line 6b Taxable amount - see instructions					
e	Undistributed income for 2010 Subtract line 4a from line 2a Taxable amount - see instructions					
f	Undistributed income for 2011 Subtract lines 4d and 5 from line 1 This amount must be distributed in 2012					
7	Amounts treated as distributions out of corpus to satisfy requirements imposed by section 170(b)(1)(F) or 4942(g)(3) (see instructions)					
8	Excess distributions carryover from 2006 not applied on line 5 or line 7 (see instructions)		4,479,130.			
9	**Excess distributions carryover to 2012.** Subtract lines 7 and 8 from line 6a		41,957,220.			
10	Analysis of line 9					
a	Excess from 2007	3,779,603.				
b	Excess from 2008	7,054,261.				
c	Excess from 2009	11,912,574.				
d	Excess from 2010	8,931,145.				
e	Excess from 2011	10,279,637.				

Part XIV Private Operating Foundations (see instructions and Part VII-A, question 9) NOT APPLICABLE

1a If the foundation has received a ruling or determination letter that it is a private operating foundation, and the ruling is effective for 2011, enter the date of the ruling . . . . ▶

b Check box to indicate whether the foundation is a private operating foundation described in section ☐ 4942(j)(3) or ☐ 4942(j)(5)

	Tax year	Prior 3 years			
	(a) 2011	(b) 2010	(c) 2009	(d) 2008	(e) Total
2a Enter the lesser of the adjusted net income from Part I or the minimum investment return from Part X for each year listed					
b 85% of line 2a					
c Qualifying distributions from Part XII, line 4 for each year listed .					
d Amounts included in line 2c not used directly for active conduct of exempt activities					
e Qualifying distributions made directly for active conduct of exempt activities Subtract line 2d from line 2c					
3 Complete 3a, b, or c for the alternative test relied upon a "Assets" alternative test - enter (1) Value of all assets . . .					
(2) Value of assets qualifying under section 4942(j)(3)(B)(i).					
b "Endowment" alternative test-enter 2/3 of minimum investment return shown in Part X, line 6 for each year listed . .					
c "Support" alternative test - enter (1) Total support other than gross investment income (interest, dividends, rents payments on securities loans (section 512(a)(5)), or royalties)					
(2) Support from general public and 5 or more exempt organizations as provided in section 4942 (j)(3)(B)(iii)					
(3) Largest amount of support from an exempt organization					
(4) Gross investment income .					

Part XV Supplementary Information (Complete this part only if the foundation had $5,000 or more in assets at any time during the year - see instructions.)

1 **Information Regarding Foundation Managers:**

a List any managers of the foundation who have contributed more than 2% of the total contributions received by the foundation before the close of any tax year (but only if they have contributed more than $5,000) (See section 507(d)(2))

CHARLES G. KOCH

b List any managers of the foundation who own 10% or more of the stock of a corporation (or an equally large portion of the ownership of a partnership or other entity) of which the foundation has a 10% or greater interest

NONE

2 **Information Regarding Contribution, Grant, Gift, Loan, Scholarship, etc., Programs:**

Check here ▶ ☐ if the foundation only makes contributions to preselected charitable organizations and does not accept unsolicited requests for funds If the foundation makes gifts, grants, etc (see instructions) to individuals or organizations under other conditions, complete items 2a, b, c, and d

a The name, address, and telephone number of the person to whom applications should be addressed.

ATTACHMENT 13

b The form in which applications should be submitted and information and materials they should include

ATTACHMENT 14

c Any submission deadlines

NONE

d Any restrictions or limitations on awards, such as by geographical areas, charitable fields, kinds of institutions, or other factors

ATTACHMENT 15

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CHARLES KOCH FOUNDATION 48-0918408

Form 990-PF (2011) Page **11**

Part XV **Supplementary Information** (continued)

3 Grants and Contributions Paid During the Year or Approved for Future Payment

Recipient Name and address (home or business)	If recipient is an individual, show any relationship to any foundation manager or substantial contributor	Foundation status of recipient	Purpose of grant or contribution	Amount
a Paid during the year ATTACHMENT 16				
Total . . . . ▶ **3a**				16,145,918.
b Approved for future payment ATTACHMENT 17				
Total . . . . ▶ **3b**				1,019,606.

Form **990-PF** (2011)

Part XVI-A Analysis of Income-Producing Activities

Enter gross amounts unless otherwise indicated	Unrelated business income		Excluded by section 512, 513, or 514		(e) Related or exempt function income (See instructions.)
	(a) Business code	(b) Amount	(c) Exclusion code	(d) Amount	
1 Program service revenue:					
a					
b					
c					
d					
e					
f					
g Fees and contracts from government agencies					
2 Membership dues and assessments					
3 Interest on savings and temporary cash investments			14	92,590.	
4 Dividends and interest from securities			14	3,462,155.	
5 Net rental income or (loss) from real estate					
a Debt-financed property					
b Not debt-financed property					
6 Net rental income or (loss) from personal property					
7 Other investment income			18	2,545,112.	
8 Gain or (loss) from sales of assets other than inventory			18	19,384.	
9 Net income or (loss) from special events					
10 Gross profit or (loss) from sales of inventory					
11 Other revenue a					
b					
c					
d					
e					
12 Subtotal. Add columns (b), (d), and (e)				6,119,241.	

13 Total. Add line 12, columns (b), (d), and (e) . . . . . 13 6,119,241.

(See worksheet in line 13 instructions to verify calculations.)

Part XVI-B Relationship of Activities to the Accomplishment of Exempt Purposes

Line No. ▼	Explain below how each activity for which income is reported in column (e) of Part XVI-A contributed importantly to the accomplishment of the foundation's exempt purposes (other than by providing funds for such purposes). (See instructions.)

Part XVII Information Regarding Transfers To and Transactions and Relationships With Noncharitable Exempt Organizations

			Yes	No
1	Did the organization directly or indirectly engage in any of the following with any other organization described in section 501(c) of the Code (other than section 501(c)(3) organizations) or in section 527, relating to political organizations?			
a	Transfers from the reporting foundation to a noncharitable exempt organization of			
	(1) Cash	1a(1)		X
	(2) Other assets	1a(2)		X
b	Other transactions			
	(1) Sales of assets to a noncharitable exempt organization	1b(1)		X
	(2) Purchases of assets from a noncharitable exempt organization	1b(2)		X
	(3) Rental of facilities, equipment, or other assets	1b(3)		X
	(4) Reimbursement arrangements	1b(4)		X
	(5) Loans or loan guarantees	1b(5)		X
	(6) Performance of services or membership or fundraising solicitations	1b(6)		X
c	Sharing of facilities, equipment, mailing lists, other assets, or paid employees	1c		X

d If the answer to any of the above is "Yes," complete the following schedule Column (b) should always show the fair market value of the goods, other assets, or services given by the reporting foundation If the foundation received less than fair market value in any transaction or sharing arrangement, show in column (d) the value of the goods, other assets, or services received

(a) Line no	(b) Amount involved	(c) Name of noncharitable exempt organization	(d) Description of transfers, transactions, and sharing arrangements
	N/A		N/A

2a Is the foundation directly or indirectly affiliated with, or related to, one or more tax-exempt organizations described in section 501(c) of the Code (other than section 501(c)(3)) or in section 527? ☐ Yes ☒ No

b If "Yes," complete the following schedule

(a) Name of organization	(b) Type of organization	(c) Description of relationship

Sign Here

Under penalties of perjury, I declare that I have examined this return, including accompanying schedules and statements, and to the best of my knowledge and belief, it is true, correct, and complete Declaration of preparer (other than taxpayer) is based on all information of which preparer has any knowledge

▶ Signature of officer or trustee | 11-15-12 Date | ▶ Treasurer Title

May the IRS discuss this return with the preparer shown below (see instructions)? ☒ Yes ☐ No

Paid Preparer Use Only				
Print/Type preparer's name ELIZABETH S. HOGAN	Preparer's signature	Date 11/12/12	Check ☐ if self-employed	PTIN P00273248
Firm's name ▶ BKD, LLP			Firm's EIN ▶ 44-0160260	
Firm's address ▶ 1551 N WATERFRONT PKWY, STE 300 WICHITA, KS 67206-6601			Phone no 316-265-2811	

Schedule B
(Form 990, 990-EZ, or 990-PF)
Department of the Treasury
Internal Revenue Service

Schedule of Contributors

▶ Attach to Form 990, Form 990-EZ, or Form 990-PF.

OMB No 1545-0047

2011

Name of the organization
CHARLES KOCH FOUNDATION

Employer identification number
48-0918408

Organization type (check one):

Filers of:	**Section:**
Form 990 or 990-EZ	☐ 501(c)( ) (enter number) organization
	☐ 4947(a)(1) nonexempt charitable trust **not** treated as a private foundation
	☐ 527 political organization
Form 990-PF	☒ 501(c)(3) exempt private foundation
	☐ 4947(a)(1) nonexempt charitable trust treated as a private foundation
	☐ 501(c)(3) taxable private foundation

Check if your organization is covered by the **General Rule** or a **Special Rule.**
Note. Only a section 501(c)(7), (8), or (10) organization can check boxes for both the General Rule and a Special Rule See instructions

General Rule

☒ For an organization filing Form 990, 990-EZ, or 990-PF that received, during the year, $5,000 or more (in money or property) from any one contributor Complete Parts I and II

Special Rules

☐ For a section 501(c)(3) organization filing Form 990 or 990-EZ that met the 33 1/3 % support test of the regulations under sections 509(a)(1) and 170(b)(1)(A)(vi) and received from any one contributor, during the year, a contribution of the greater of **(1)** $5,000 or **(2)** 2% of the amount on (i) Form 990, Part VIII, line 1h, or (ii) Form 990-EZ, line 1 Complete Parts I and II

☐ For a section 501(c)(7), (8), or (10) organization filing Form 990 or 990-EZ that received from any one contributor, during the year, total contributions of more than $1,000 for use *exclusively* for religious, charitable, scientific, literary, or educational purposes, or the prevention of cruelty to children or animals Complete Parts I, II, and III

☐ For a section 501(c)(7), (8), or (10) organization filing Form 990 or 990-EZ that received from any one contributor, during the year, contributions for use *exclusively* for religious, charitable, etc , purposes, but these contributions did not total to more than $1,000 If this box is checked, enter here the total contributions that were received during the year for an *exclusively* religious, charitable, etc , purpose Do not complete any of the parts unless the **General Rule** applies to this organization because it received nonexclusively religious, charitable, etc , contributions of $5,000 or more during the year . . . . ▶ $ ________

Caution. An organization that is not covered by the General Rule and/or the Special Rules does not file Schedule B (Form 990, 990-EZ, or 990-PF), but it **must** answer "No" on Part IV, line 2, of its Form 990, or check the box on line H of its Form 990-EZ or on Part I, line 2, of its Form 990-PF, to certify that it does not meet the filing requirements of Schedule B (Form 990, 990-EZ, or 990-PF)

For Paperwork Reduction Act Notice, see the Instructions for Form 990, 990-EZ, or 990-PF. **Schedule B (Form 990, 990-EZ, or 990-PF) (2011)**

Schedule B (Form 990, 990-EZ, or 990-PF) (2011) Page **2**

Name of organization CHARLES KOCH FOUNDATION

Employer identification number
48-0918408

Part I **Contributors** (see instructions) Use duplicate copies of Part I if additional space is needed.

(a) No.	(b) Name, address, and ZIP + 4	(c) Total contributions	(d) Type of contribution
1	CHARLES G. KOCH 4111 E. 37TH STREET N. WICHITA, KS 67220	$ 26,427.	Person ☒ Payroll ☐ Noncash ☐ (Complete Part II if there is a noncash contribution)
(a) No.	(b) Name, address, and ZIP + 4	(c) Total contributions	(d) Type of contribution
		$	Person ☐ Payroll ☐ Noncash ☐ (Complete Part II if there is a noncash contribution)
(a) No.	(b) Name, address, and ZIP + 4	(c) Total contributions	(d) Type of contribution
		$	Person ☐ Payroll ☐ Noncash ☐ (Complete Part II if there is a noncash contribution)
(a) No.	(b) Name, address, and ZIP + 4	(c) Total contributions	(d) Type of contribution
		$	Person ☐ Payroll ☐ Noncash ☐ (Complete Part II if there is a noncash contribution)
(a) No.	(b) Name, address, and ZIP + 4	(c) Total contributions	(d) Type of contribution
		$	Person ☐ Payroll ☐ Noncash ☐ (Complete Part II if there is a noncash contribution)
(a) No.	(b) Name, address, and ZIP + 4	(c) Total contributions	(d) Type of contribution
		$	Person ☐ Payroll ☐ Noncash ☐ (Complete Part II if there is a noncash contribution)

JSA Schedule B (Form 990, 990-EZ, or 990-PF) (2011)

Name of organization CHARLES KOCH FOUNDATION

Employer identification number 48-0918408

Part II **Noncash Property** (see instructions). Use duplicate copies of Part II if additional space is needed

(a) No. from Part I	(b) Description of noncash property given	(c) FMV (or estimate) (see instructions)	(d) Date received
		$	

(a) No. from Part I	(b) Description of noncash property given	(c) FMV (or estimate) (see instructions)	(d) Date received
		$	

(a) No. from Part I	(b) Description of noncash property given	(c) FMV (or estimate) (see instructions)	(d) Date received
		$	

(a) No. from Part I	(b) Description of noncash property given	(c) FMV (or estimate) (see instructions)	(d) Date received
		$	

(a) No. from Part I	(b) Description of noncash property given	(c) FMV (or estimate) (see instructions)	(d) Date received
		$	

(a) No. from Part I	(b) Description of noncash property given	(c) FMV (or estimate) (see instructions)	(d) Date received
		$	

Schedule B (Form 990, 990-EZ, or 990-PF) (2011) Page 4

Name of organization CHARLES KOCH FOUNDATION

Employer identification number 48-0918408

Part III ***Exclusively*** **religious, charitable, etc., individual contributions to section 501(c)(7), (8), or (10) organizations that total more than $1,000 for the year.** Complete columns **(a)** through **(e)** and the following line entry

For organizations completing Part III, enter the total of *exclusively* religious, charitable, etc., contributions of **$1,000 or less** for the year (Enter this information once See instructions.) ▶ $

Use duplicate copies of Part III if additional space is needed

(a) No. from Part I	(b) Purpose of gift	(c) Use of gift	(d) Description of how gift is held

(e) Transfer of gift

Transferee's name, address, and ZIP + 4	Relationship of transferor to transferee

(a) No. from Part I	(b) Purpose of gift	(c) Use of gift	(d) Description of how gift is held

(e) Transfer of gift

Transferee's name, address, and ZIP + 4	Relationship of transferor to transferee

(a) No. from Part I	(b) Purpose of gift	(c) Use of gift	(d) Description of how gift is held

(e) Transfer of gift

Transferee's name, address, and ZIP + 4	Relationship of transferor to transferee

(a) No. from Part I	(b) Purpose of gift	(c) Use of gift	(d) Description of how gift is held

(e) Transfer of gift

Transferee's name, address, and ZIP + 4	Relationship of transferor to transferee

JSA

Schedule B (Form 990, 990-EZ, or 990-PF) (2011)

1E1255 1 000

FORM 990PF - GENERAL EXPLANATION ATTACHMENT

SUMMARY OF DIRECT CHARITABLE ACTIVITIES
FORM 990-PF, PART IX-A

KOCH ASSOCIATES PROGRAM:

DURING 2011 THE CHARLES KOCH FOUNDATION SPONSORED MORE THAN 80 INDIVIDUALS TO PARTICIPATE IN THE KOCH ASSOCIATE PROGRAM. 25 WASHINGTON, D.C. AREA CHARITABLE ORGANIZATIONS WERE PARTNERS IN THE PROGRAM.

THE KOCH ASSOCIATE PROGRAM WAS ESTABLISHED TO IDENTIFY UP-AND-COMING LEADERS AND ENTREPRENEURS INTERESTED IN LIBERTY AND HELP THEM DEVELOP THE KNOWLEDGE, SKILLS, AND EXPERIENCE NECESSARY FOR CAREERS IN THE NONPROFIT SECTOR, INCLUDING CAREERS WITH MARKET-ORIENTED THINK TANKS, POLICY INSTITUTES, AND OTHER EDUCATIONAL INSTITUTIONS.

FOR MORE INFORMATION ON THIS PROGRAM, PLEASE VISIT THE FOUNDATION'S WEBSITE AT: WWW.CHARLESKOCHFOUNDATION.ORG

KOCH INTERSHIP PROGRAM:

DURING 2011 THE CHARLES KOCH FOUNDATION SPONSORED MORE THAN 113 INDIVIDUALS TO PARTICIPATE IN THE KOCH INTERNSHIP PROGRAM.
THE CHARLES KOCH FOUNDATION INTERNSHIP PROGRAM WAS ESTABLISHED TO DEVELOP THE NEXT GENERATION OF LIBERTY-MINDED LEADERS, EDUCATORS, AND ENTREPRENEURS. OVER THE COURSE OF THE PROGRAM, INTERNS ENGAGE IN RESEARCH AND EDUCATIONAL ACTIVITIES WHILE LEARNING AND APPLYING MARKET-BASED MANAGEMENT®

FOR MORE INFORMATION ON THIS PROGRAM, PLEASE VISIT THE FOUNDATION'S WEBSITE AT: WWW.CHARLESKOCHFOUNDATION.ORG

LIBERTY @ WORK PROGRAM:

DURING 2011 THE CHARLES KOCH FOUNDATION SPONSORED MORE THAN 42 INDIVIDUALS TO PARTICIPATE IN THE KOCH ASSOCIATE PROGRAM. 32 CHARITABLE ORGANIZATIONS OUTSIDE OF THE WASHINGTON D.C. AREA WERE PARTNERS IN THE PROGRAM.

THE LIBERTY @ WORK PROGRAM WAS ESTABLISHED TO IDENTIFY UP-AND-COMING LEADERS AND ENTREPRENEURS INTERESTED IN LIBERTY AND HELP THEM DEVELOP THE KNOWLEDGE, SKILLS, AND EXPERIENCE NECESSARY FOR CAREERS IN THE NONPROFIT SECTOR, INCLUDING CAREERS WITH MARKET-ORIENTED THINK TANKS, POLICY

FORM 990PF - GENERAL EXPLANATION ATTACHMENT

INSTITUTES, AND OTHER EDUCATIONAL INSTITUTIONS OUTSIDE THE WASHINGTON D.C. AREA.

FOR MORE INFORMATION ON THIS PROGRAM, PLEASE VISIT THE FOUNDATION'S WEBSITE AT: WWW.CHARLESKOCHFOUNDATION.ORG

ATTACHMENT 1

FORM 990PF, PART I - OTHER INCOME

DESCRIPTION		REVENUE AND EXPENSES PER BOOKS	NET INVESTMENT INCOME
OTHER INCOME - LAND RENT		360.	360.
OTHER INCOME - MISCELLANEOUS		19,000.	
GAIN/LOSS ON DISPOSAL OF ASSETS		24.	
	TOTALS	19,384.	360.

ATTACHMENT 2

FORM 990PF, PART I - LEGAL FEES

DESCRIPTION		REVENUE AND EXPENSES PER BOOKS	NET INVESTMENT INCOME	ADJUSTED NET INCOME	CHARITABLE PURPOSES
LEGAL SERVICES		22,393.			22,393.
	TOTALS	22,393.			22,393.

ATTACHMENT 3

FORM 990PF, PART I - ACCOUNTING FEES

DESCRIPTION	REVENUE AND EXPENSES PER BOOKS	NET INVESTMENT INCOME	ADJUSTED NET INCOME	CHARITABLE PURPOSES
ACCOUNTING FEES	136,022.			142,697.
INVESTMENT ACCTG SERVICES FEES	2,601.	2,601.		
TOTALS	138,623.	2,601.		142,697.

ATTACHMENT 4

FORM 990PF, PART I - OTHER PROFESSIONAL FEES

DESCRIPTION	REVENUE AND EXPENSES PER BOOKS	NET INVESTMENT INCOME	CHARITABLE PURPOSES
PROFESSIONAL CONSULTING FEES	294,196.		294,196.
INVESTMENT MANAGEMENT FEES	330,308.	330,308.	
LAND MAINTENANCE FEES	1,508.	1,508.	
WEBSITE FEES	10,901.		10,901.
CORPORATE FILING FEES	163.		163.
OTHER PROFESSIONAL FEES	111,949.		111,949.
RECRUITING FEES	21,692.		21,692.
TEMPORARY HELP	41,953.		41,953.
ADVERTISING FEES	75,172.		75,172.
SPEAKER FEES	14,750.		14,750.
ON-LINE SERVICE FEES	40,994.		40,994.
EQUIPMENT/MAINTENANCE	21,896.		21,896.
KAP PARTICIPATION FEES	545,078.		560,610.
L@W PARTICIPATION FEES	171,250.		171,250.
TOTALS	1,681,810.	331,816.	1,365,526.

ATTACHMENT 5

FORM 990PF, PART I - TAXES

DESCRIPTION	REVENUE AND EXPENSES PER BOOKS	NET INVESTMENT INCOME	CHARITABLE PURPOSES
FEDERAL EXCISE TAX	115,315.		
REAL ESTATE TAXES	73.	73.	
VA BUSINESS PROPERTY TAX	20,720.		20,720.
TOTALS	136,108.	73.	20,720.

ATTACHMENT 6

FORM 990PF, PART I - OTHER EXPENSES

DESCRIPTION	REVENUE AND EXPENSES PER BOOKS	CHARITABLE PURPOSES
INSURANCE	37,996.	37,996.
POSTAGE & DELIVERY	8,640.	8,640.
BANK FEES	1,052.	1,052.
SUPPLIES	52,763.	52,763.
TELEPHONE	15,848.	15,848.
MEMBERSHIP & DUES	1,658.	1,658.
AWARDS/INCENTIVES	3,149.	3,149.
GIFTS	725.	725.
GIFTS - IN-KIND	368,455.	368,455.
LICENSE FEES	37,632.	37,632.
ACCOUNTS RECEIVABLE WRITE-OFF	7,025.	7,025.
INTERNET	4,104.	4,104.
MISCELLANEOUS	283.	283.
TOTALS	539,330.	539,330.

FORM 990-PF - PART IV
CAPITAL GAINS AND LOSSES FOR TAX ON INVESTMENT INCOME

Kind of Property		Description				P or D	Date acquired	Date sold
Gross sale price less expenses of sale	Depreciation allowed/ allowable	Cost or other basis	FMV as of 12/31/69	Adj basis as of 12/31/69	Excess of FMV over adj basis		Gain or (loss)	
		ZAZOVE ASSOCIATES, LLC				P	VARIOUS	VARIOUS
		PROPERTY TYPE: SECURITIES						
972,037.		994,248.					-22,211.	
		ZAZOVE ASSOCIATES, LLC				P	VARIOUS	VARIOUS
		PROPERTY TYPE: SECURITIES						
2,020,548.		1,845,833.					174,715.	
		ACIS CLO				P	VARIOUS	VARIOUS
		PROPERTY TYPE: SECURITIES						
8,964,429.		8,791,432.					172,997.	
		ACIS CLO				P	VARIOUS	VARIOUS
		PROPERTY TYPE: SECURITIES						
1,308,000.		1,610,000.					-302,000.	
		PIMCO				P	VARIOUS	VARIOUS
		PROPERTY TYPE: SECURITIES						
27459154.		26569477.					889,677.	
		PILOT TRAVEL CENTERS				P	VARIOUS	VARIOUS
		PROPERTY TYPE: SECURITIES						
11607222.		10000000.					1,607,222.	
		EATON VANCE				P	VARIOUS	VARIOUS
		PROPERTY TYPE: SECURITIES						
331,278.		306,566.					24,712.	
TOTAL GAIN(LOSS)							2,545,112.	

CHARLES KOCH FOUNDATION 48-0918408

INVESTMENTS - LAND, BUILDINGS, EQUIPMENT

ATTACHMENT 7

		FIXED ASSET DETAIL				ACCUMULATED DEPRECIATION DETAIL			
ASSET DESCRIPTION	METHOD/ CLASS	BEGINNING BALANCE	ADDITIONS	DISPOSALS	ENDING BALANCE	BEGINNING BALANCE	ADDITIONS	DISPOSALS	ENDING BALANCE
UNIMPROVED LAND	L	3,377,694			3,377,694				
TOTALS		3,377,694			3,377,694				

ATTACHMENT 8

FORM 990PF, PART II - OTHER INVESTMENTS

DESCRIPTION	ENDING BOOK VALUE	ENDING FMV
ZAZOVE FUND	7,122,377.	7,378,753.
EATON VANCE FUND		
EXCELSIOR ABSOLUTE FUND	16,627.	48,563.
ELLIOT INTERNATIONAL FUND	49,689,725.	49,918,819.
HIGHLAND COMMINGLED FUND	10,000,000.	12,106,819.
MPAM FUND	35,000,000.	34,621,681.
PILOT TRAVEL CENTERS		
PIMCO FUND		
WEBER STEPHEN PRODUCTS	25,666,667.	26,000,000.
WINTON FUTURES FUND	25,000,000.	26,158,101.
ACIS	50,543,046.	45,460,590.
TOTALS	203,038,442.	201,693,326.

CHARLES KOCH FOUNDATION 48-0918408

LAND, BUILDINGS, EQUIPMENT NOT HELD FOR INVESTMENT

ATTACHMENT 9

ASSET DESCRIPTION	METHOD/ CLASS	FIXED ASSET DETAIL				ACCUMULATED DEPRECIATION DETAIL			
		BEGINNING BALANCE	ADDITIONS	DISPOSALS	ENDING BALANCE	BEGINNING BALANCE	ADDITIONS	DISPOSALS	ENDING BALANCE
OFFICE EQUIPMENT	SL		16,630		16,630		1,440		1,440
LEASEHOLD IMPROVE	SL	1,000,652			1,000,652.	613,038.	194,641.		807,679.
LEASEHOLD IMPROVE	SL		2,932		2,932		272		272.
TOTALS		1,000,652			1,020,214	613,038			809,391

ATTACHMENT 10

FORM 990PF, PART VII-B, LINE 5C-EXPENDITURE RESPONSIBILITY STATEMENT

GRANTEE'S NAME: MARKET-BASED MANAGEMENT INSTITUTE
GRANTEE'S ADDRESS: 4111 E 37TH STREET N
CITY, STATE & ZIP: WICHITA, KS 67220
GRANT DATE: 04/21/2011
GRANT AMOUNT: 185,000.
GRANT PURPOSE: GENERAL OPERATING SUPPORT
AMOUNT EXPENDED: 185,000.
ANY DIVERSION? NO
DATES OF REPORTS: 08/24/2012 FULL AND COMPLETE REPORT OF ALL EXPENDITURES
VERIFICATION DATE:
RESULTS OF VERIFICATION:

THE GRANTOR HAS NO REASON TO DOUBT THE ACCURACY OR RELIABILITY OF THE REPORT FROM THE GRANTEE; THEREFORE, NO INDEPENDENT VERIFICATION OF THE REPORTS WERE MADE.

GRANTEE'S NAME: THE PHILLIPS FOUNDATION
GRANTEE'S ADDRESS: ONE MASSACHUSSETS AVENUE, NW SUITE 620
CITY, STATE & ZIP: WASHINGTON, DC 20001
GRANT DATE: 05/19/2011
GRANT AMOUNT: 30,000.
GRANT PURPOSE: SUPPORT FELLOWSHIP PROGRAM
AMOUNT EXPENDED: 30,000.
ANY DIVERSION? NO
DATES OF REPORTS: 12/28/2011 FULL REPORT OF ALL GRANT EXPENDITURES
VERIFICATION DATE:
RESULTS OF VERIFICATION:

THE GRANTOR HAS NO REASON TO DOUBT THE ACCURACY OR RELIABILITY OF THE REPORT FROM THE GRANTEE; THEREFORE, NO INDEPENDENT VERIFICATION OF THE REPORTS WERE MADE.

CHARLES KOCH FOUNDATION 48-0918408

FORM 990PF, PART VIII - LIST OF OFFICERS, DIRECTORS, AND TRUSTEES

ATTACHMENT 11

NAME AND ADDRESS	TITLE AND AVERAGE HOURS PER WEEK DEVOTED TO POSITION	COMPENSATION	CONTRIBUTIONS TO EMPLOYEE BENEFIT PLANS	EXPENSE ACCT AND OTHER ALLOWANCES
CHARLES CHASE KOCH P.O. BOX 2256 WICHITA, KS 67201-2256	DIRECTOR .25	0	0	0
ELIZABETH ROBINSON KOCH P.O. BOX 2256 WICHITA, KS 67201-2256	DIRECTOR .25	0	0	0
ELIZABETH B KOCH P.O. BOX 2256 WICHITA, KS 67201-2256	DIRECTOR .25	0	0	0
CHARLES G KOCH P.O. BOX 2256 WICHITA, KS 67201-2256	DIRECTOR/ CHAIRMAN .25	0	0	0
VONDA HOLLIMAN P.O. BOX 2256 WICHITA, KS 67201-2256	TREASURER 1.00	0	0	0
JOY RAUM 1515 N. COURTHOUSE RD, SUITE 200 ARLINGTON, VA 22201	ASSISTANT SECRETARY .25	0	0	0

CHARLES KOCH FOUNDATION 48-0918408

FORM 990PF, PART VIII - LIST OF OFFICERS, DIRECTORS, AND TRUSTEES

ATTACHMENT 11 (CONT'D)

NAME AND ADDRESS	TITLE AND AVERAGE HOURS PER WEEK DEVOTED TO POSITION	COMPENSATION	CONTRIBUTIONS TO EMPLOYEE BENEFIT PLANS	EXPENSE ACCT AND OTHER ALLOWANCES
BRIAN MENKES 1515 N. COURTHOUSE RD, SUITE 200 ARLINGTON, VA 22201	SECRETARY 1.00	0	0	0
KEVIN L GENTRY 1515 N. COURTHOUSE RD, SUITE 200 ARLINGTON, VA 22201	VICE PRESIDENT 1.00	0	0	0
RICHARD H FINK 1515 N. COURTHOUSE RD, SUITE 200 ARLINGTON, VA 22201	PRESIDENT/DIRECTOR 1.00	0	0	0
	GRAND TOTALS	0	0	0

990PF, PART VIII - COMPENSATION OF THE FIVE HIGHEST PAID EMPLOYEES

ATTACHMENT 12

NAME AND ADDRESS	TITLE AND AVERAGE HOURS PER WEEK DEVOTED TO POSITION	COMPENSATION	CONTRIBUTIONS TO EMPLOYEE BENEFIT PLANS	EXPENSE ACCT AND OTHER ALLOWANCES
LOGAN MOORE 1515 N. COURTHOUSE RD, STE 200 ARLINGTON, VA 22201	DIR OF OPERATIONS 40.00	135,000.	4,780.	1,200.
RYAN STOWERS 1515 N. COURTHOUSE RD, STE 200 ARLINGTON, VA 22201	PGM DIR HIGHER EDUC 40.00	185,000.	10,830.	1,440.
ARIANNE MASSEY 1515 N. COURTHOUSE RD, STE 200 ARLINGTON, VA 22201	PGM DIR TALENT/HR 40.00	130,000.	2,519.	1,200.
KRISTEN SHORT 1515 N. COURTHOUSE RD, STE 200 ARLINGTON, VA 22201	SR DEVELOP ASSOCIATE 40.00	89,866.	0	1,440.
DAN JORJANI 1515 N. COURTHOUSE RD, STE 200 ARLINGTON, VA 22201	PGM OFFICER RESEARCH 40.00	100,500.	7,220.	1,200.
	TOTAL COMPENSATION	640,366.	25,349.	6,480.

ATTACHMENT 13

FORM 990PF, PART XV - NAME, ADDRESS AND PHONE FOR APPLICATIONS

CHARLES KOCH FOUNDATION
1515 N. COURTHOUSE ROAD, SUITE 200
ARLINGTON, VA 22201
703-875-1600

ATTACHMENT 14

990PF, PART XV - FORM AND CONTENTS OF SUBMITTED APPLICATIONS

ORGANIZATIONS SEEKING GRANTS FROM THE FOUNDATION AND WHICH MEET THE CRITERIA LISTED IN ATTACHMENT 15 SHOULD SUBMIT A SHORT LETTER (NO MORE THAN THREE PAGES) OUTLINING THEIR REQUEST. THE LETTER SHOULD CLEARLY AND SUCCINCTLY STATE:

1. PROSPECTIVE GRANTEE'S MISSION AND GOALS;
2. SPECIFIC PROJECT FOR WHICH SUPPORT IS BEING SOUGHT;
3. AMOUNT OF FUNDING REQUESTED;
4. NAME, TITLE, ADDRESS, TELEPHONE NUMBER, AND EMAIL ADDRESS OF THE PRIMARY CONTACT PERSON; AND,
5. CURRENT ANNUAL BUDGET OR AUDITED FINANCIAL STATEMENTS

IF APPLICABLE, PLEASE ALSO INCLUDE A LIST OF OTHER SUPPORT (E.G., FUNDING, IN-KIND CONTRIBUTIONS) SECURED FOR THE PROJECT. BECAUSE THE FOUNDATION GENERALLY ONLY SUPPORTS SECTION 501(C)(3) PUBLIC CHARITIES, IT ALSO REQUIRES THAT YOU SUBMIT VERIFICATION FROM THE IRS THAT YOUR ORGANIZATION IS EXEMPT FROM FEDERAL INCOME TAX AS A SECTION 501(C)(3) ORGANIZATION AND IS CLASSIFIED AS A PUBLIC CHARITY UNDER SECTION 509(A) OF THE INTERNAL REVENUE CODE. THE FOUNDATION KINDLY REQUESTS THAT NO MATERIALS BEYOND WHAT ARE DESCRIBED ABOVE BE INCLUDED.

ATTACHMENT 15

990PF, PART XV - RESTRICTIONS OR LIMITATIONS ON AWARDS

THE FOUNDATION PRIMARILY SUPPORTS RESEARCH AND EDUCATION PROGRAMS THAT ANALYZE THE IMPACT OF FREE SOCIETIES, IN PARTICULAR HOW THEY ADVANCE THE WELL-BEING OF MANKIND. BUILDING ON THIS KNOWLEDGE, THE CHARLES KOCH FOUNDATION FOSTERS THE PARTNERSHIP OF SCIENTISTS AND PRACTITIONERS IN ORDER TO INTEGRATE THEORY AND PRACTICE. BY DOING SO, THE FOUNDATION STRIVES TO DEVELOP MARKET-BASED TOOLS THAT ENABLE INDIVIDUALS, INSTITUTIONS AND SOCIETIES TO PROSPER. THE CHARLES KOCH FOUNDATION FOCUSES ON A SELECT NUMBER OF PROGRAMS WHERE IT BELIEVES IT IS BEST POSITIONED TO SUPPORT POSITIVE SOCIAL CHANGE. THE FOUNDATION ENCOURAGES ORGANIZATIONS SEEKING SUPPORT TO FIRST FAMILIARIZE THEMSELVES WITH THOSE DOMAINS BY EXAMINING THE FOUNDATION'S AREAS OF INTEREST. IN ADDITION, THE FOUNDATION PLACES SEVERAL LIMITATIONS ON THE REQUESTS IT CONSIDERS.

1. THE FOUNDATION PRIMARILY MAKES GRANTS TO SECTION 501(C)(3) PUBLIC CHARITIES. THE CHARLES KOCH FOUNDATION DOES NOT SUPPORT FOR-PROFIT CORPORATIONS OR INDIVIDUALS.
2. THE FOUNDATION DISCOURAGES GRANT PROPOSALS FOR CAPITAL CONSTRUCTION, DEBT REDUCTION, OR GENERAL FUNDRAISING DRIVES OR EVENTS. THE FOUNDATION DOES NOT MAKE GRANTS TO SUPPORT LOBBYING ACTIVITIES OR CANDIDATES FOR PUBLIC OFFICE. THE FOUNDATION RARELY FUNDS ENDOWMENTS.

CHARLES KOCH FOUNDATION 48-0918408

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
BILL OF RIGHTS INSTITUTE 200 N GLEBE ROAD SUITE 200 ARLINGTON, VA 22203	NONE PUBLIC	EDUCATIONAL PROGRAMS	350,000
CLEMSON UNIVERSITY DEPARTMENT OF ECONOMICS 201 SIKES HALL - BOX 345123 CLEMSON, SC 29634-1301	NONE PUBLIC	EDUCATIONAL PROGRAMS	250,000
FLORIDA STATE UNIVERSITY FOUNDATION 113 COLLEGIATE LOOP PO BOX 3062160 TALLAHASSEE, FL 32306-2160	NONE PUBLIC	EDUCATIONAL PROGRAMS	250,000.
JACK MILLER CENTER 111 PRESIDENTIAL BLVD., #146 PHILADELPHIA, PA 19004	NONE PUBLIC	EDUCATIONAL PROGRAMS	250,000
SOUTHERN METHODIST UNIVERSITY PO BOX 750333 SUITE 901 DALLAS, TX 75275-0333	NONE PUBLIC	EDUCATIONAL PROGRAMS	101,000
TROY UNIVERSITY FOUNDATION 211 WRIGHT HALL TROY, AL 36082	NONE PUBLIC	EDUCATIONAL PROGRAMS	240,000.

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
UNIVERSITY OF ARIZONA FOUNDATION 1111 NORTH CHERRY AVENUE TUCSON, AZ 85721	NONE PUBLIC	EDUCATIONAL PROGRAMS	200,000
UTAH STATE UNIVERSITY FOUNDATION 1420 OLD MAIN HILL PO BOX 210109 LOGAN, UT 84322-1420	NONE PUBLIC	EDUCATIONAL PROGRAMS	125,000
WEST VIRGINIA UNIVERSITY FOUNDATION 1 WATERFRONT PLACE 7TH FLOOR MORGANTOWN, WV 26507-1650	NONE PUBLIC	EDUCATIONAL PROGRAMS	200,000
SALVATION ARMY 615 SLATERS LANE PO BOX 1650 ALEXANDRIA, VA 22313	NONE PUBLIC	EDUCATIONAL PROGRAMS	35,000
THE PHILLIPS FOUNDATION ONE MASSACHUSETTS AVE., NW WASHINGTON, DC 20001	NONE PRIVATE	EDUCATIONAL PROGRAMS	4,600.
YMCA OF WICHITA KANSAS 3330 N WOODLAWN SUITE 620 WICHITA, KS 67220-2202	NONE PUBLIC	EDUCATIONAL PROGRAMS	5,000.

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
GEORGE MASON UNIVERSITY FOUNDATION 4400 UNIVERSITY DRIVE FAIRFAX, VA 22030	NONE PUBLIC	EDUCATIONAL PROGRAMS	4,157,548
INSTITUTE FOR HUMANE STUDIES 3301 N FAIRFAX DR ARLINGTON, VA 22201	NONE PUBLIC	EDUCATIONAL PROGRAMS	3,671,500
ACADEMY ON CAPITALISM AND LIMITED GOV FDN 528 E GREEN ST , SUITE 202 SUITE 440 CHAMPAIGN, IL 61820	NONE PUBLIC	EDUCATIONAL PROGRAMS	80,000.
FLORIDA STATE UNIVERSITY 211 WESTCOTT BUILDING TALLAHASSEE, FL 32306-1470	NONE PUBLIC	EDUCATIONAL PROGRAMS	123,765
GEORGE WASHINGTON UNIVERSITY 805 21ST STREET NW WASHINGTON, DC 20052	NONE PUBLIC	RESEARCH	4,500
NEW YORK UNIVERSITY 19 W 4TH STREET SUITE 612 NEW YORK, NY 10012	NONE PUBLIC	EDUCATIONAL PROGRAMS	35,500.

CHARLES KOCH FOUNDATION 48-0918408

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
SUFFOLK UNIVERSITY 8 ASHBURTON PLACE SUITE 200 BOSTON, MS 02108-2770	NONE PUBLIC	EDUCATIONAL PROGRAMS	91,692
UNIVERSITY OF NORTH CAROLINA - CHAPEL HILL 103 SOUTH BUILDING, CB 9100 CHAPEL HILL, NC 27599	NONE PUBLIC	EDUCATIONAL PROGRAMS	100,000.
WEST VIRGINIA UNIVERSITY FOUNDATION 1 WATERFRONT PLACE 7TH FLOOR MORGANTOWN, WV 26507-1650	NONE PUBLIC	EDUCATIONAL PROGRAMS	72,100
MARKET-BASED MANAGEMENT INSTITUTE 4111 EAST 37TH STREET NORTH PO BOX 1650 WICHITA, KS 67226	NONE PRIVATE	EDUCATIONAL PROGRAMS	185,000.
AMERICAN COUNCIL OF TRUSTEES AND ALUMNI 1726 M STREET NW WASHINGTON, DC 20036-4525	NONE PUBLIC	GENERAL OPERATING SUPPORT	25,000.
DONORS TRUST 109 NORTH HENRY ST SUITE 802 ALEXANDRIA, VA 22314	NONE PUBLIC	GENERAL OPERATING SUPPORT	50,000.

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
FOUNDATION FOR INDIVIDUAL RIGHTS IN EDUCATION 601 WALNUT STREET PHILADELPHIA, PA 19106	NONE PUBLIC	GENERAL OPERATING SUPPORT	75,000.
PHILANTHROPY ROUNDTABLE 1150 - 17TH ST NW SUITE 510 WASHINGTON, DC 20036	NONE PUBLIC	GENERAL OPERATING SUPPORT	25,000
GEORGIA PUBLIC POLICY FOUNDATION 6100 LAKE FORREST DR SUITE 503 ATLANTA, GA 30328	NONE PUBLIC	RESEARCH	1,750
PACIFIC RESEARCH INSTITUTE ONE EMBARCADERO CENTER SUITE 110 SAN FRANCISCO, CA 94111	NONE PUBLIC	RESEARCH	2,000.
UTAH STATE UNIVERSITY 1400 OLD MAIN HILL SUITE 350 LOGAN, UT 84322-1400	NONE PUBLIC	RESEARCH	35,000
ACTON INSTITUTE 161 OTTAWA AVENUE NW GRAND RAPIDS, MI 49503-2718	NONE PUBLIC	EDUCATIONAL PROGRAMS	50,000

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
HEARTLAND INSTITUTE 19 S LASALLE SUITE 301 CHICAGO, IL 60603	NONE PUBLIC	RESEARCH	25,000.
GEORGE MASON UNIVERSITY FOUNDATION 4400 UNIVERSITY DRIVE FAIRFAX, VA 22030	NONE PUBLIC	EDUCATIONAL PROGRAMS	250,000.
TEXAS PUBLIC POLICY FOUNDATION 900 CONGRESS AVE AUSTIN, TX 78701	NONE PUBLIC	EDUCATIONAL PROGRAMS	30,000
COMMONWEALTH FOUNDATION 225 STATE STREET, SUITE 302 STUITE 400 HARRISBURG, PA 17101	NONE PUBLIC	EDUCATIONAL PROGRAMS	5,583
AMERICAN ENTERPRISE INSTITUTE 1150 SEVENTEENTH ST , NW WASHINGTON, DC 20036	NONE PUBLIC	GENERAL OPERATING SUPPORT	200,000
BERNARD CENTER 10120 CHAPEL ROAD POTOMAC, MD 20854	NONE PUBLIC	GENERAL OPERATING SUPPORT	25,000.

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
CAPITAL RESEARCH CENTER 1513 16TH STREET NW WASHINGTON, DC 20036-1480	NONE PUBLIC	GENERAL OPERATING SUPPORT	10,000.
THE PHILLIPS FOUNDATION ONE MASSACHUSETTS AVE , NW WASHINGTON, DC 20001	NONE PRIVATE	EDUCATIONAL PROGRAMS	25,000
AMERICAN SPECTATOR FOUNDATION 1611 N. KENT ST SUITE 620 ARLINGTON, VA 22209	NONE PUBLIC	EDUCATIONAL PROGRAMS	10,000.
AMERICA'S FUTURE FOUNDATION 1899 L STREET NW SUITE 901 WASHINGTON, DC 20036	NONE PUBLIC	EDUCATIONAL PROGRAMS	700
BLUEGRASS INSTITUTE FOR PUBLIC POLICY SOLUTIONS 400 E MAIN STREET SUITE 1200 BOWLING GREEN, KY 42102	NONE PUBLIC	EDUCATIONAL PROGRAMS	5,200
DONORS TRUST 109 NORTH HENRY ST SUITE 306 ALEXANDRIA, VA 22314	NONE PUBLIC	EDUCATIONAL PROGRAMS	25,000

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
LIBERTY ON THE ROCKS 13952 DENVER WEST PKWY SUITE 510 GOLDEN, CO 80401	NONE PUBLIC	EDUCATIONAL PROGRAMS	300.
NETWORK OF ENLIGHTENED WOMEN 6501 DEAN ROAD STE 400 INDIANAPOLIS, IN 46220	NONE PUBLIC	GENERAL OPERATING SUPPORT	3,000
STUDENTS FOR LIBERTY PO BOX 17321 ARLINGTON, VA 22216	NONE PUBLIC	GENERAL OPERATING SUPPORT	25,000.
THE FUND FOR AMERICAN STUDIES 1706 NEW HAMPSHIRE AVE , NW WASHINGTON, DC 20009	NONE PUBLIC	GENERAL OPERATING SUPPORT	15,000.
ALEXANDER HAMILTON INSTITUTE 21 WEST PARK CLINTON, NY 13323	NONE PUBLIC	EDUCATIONAL PROGRAMS	9,000.
ALMA COLLEGE 614 W SUPERIOR ST ALMA, MI 48801	NONE PUBLIC	EDUCATIONAL PROGRAMS	8,000

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
ARKANSAS TECH UNIVERSITY 1509 NORTH BOULDER AVE RUSSELLVILLE,, AK 72801	NONE PUBLIC	EDUCATIONAL PROGRAMS	12,500
AZUSA PACIFIC UNIVERSITY 901 E. ALOSTA AVE. AZUSA, CA 91702-7000	NONE PUBLIC	EDUCATIONAL PROGRAMS	23,500
BARTON COLLEGE PO BOX 5000 WILSON, NC 27893	NONE PUBLIC	EDUCATIONAL PROGRAMS	5,000
BELOIT COLLEGE 700 COLLEGE STREET BELOIT, WI 53511	NONE PUBLIC	EDUCATIONAL PROGRAMS	32,000.
BERRY COLLEGE PO BOX 495024 MOUNT BERRY, GA 30149-5024	NONE PUBLIC	EDUCATIONAL PROGRAMS	15,000
BETHEL COLLEGE 1001 BETHEL CIRCLE #3010 MISHAWAKA, IN 46545	NONE PUBLIC	EDUCATIONAL PROGRAMS	9,600.

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
BOISE STATE UNIVERSITY FOUNDATION 2225 UNIVERSITY DRIVE BOISE, ID 83706	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,470
BROWN UNIVERSITY 71 GEORGE ST PROVIDENCE, RI 02912-1000	NONE PUBLIC	EDUCATIONAL PROGRAMS	37,500
BUENA VISTA UNIVERSITY 610 W FOURTH STREET STORM LAKE, IA 50588	NONE PUBLIC	EDUCATIONAL PROGRAMS	1,000.
CALIFORNIA STATE UNIVERSITY EAST BAY FOUNDATION 25976 CARLOS BEE BLVD HAYWARD, CA 94542	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,000.
CAMPBELL UNIVERSITY PO BOX 218 BUIES CREEK, NC 27506	NONE PUBLIC	EDUCATIONAL PROGRAMS	16,093
CARNEGIE MELLON UNIVERSITY 5000 FORBES AVENUE SUITE 440 PITTSBURGH, PA 15213-3890	NONE PUBLIC	EDUCATIONAL PROGRAMS	5,850

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
CARTHAGE COLLEGE 2001 ALFORD PARK DRIVE #146 KENOSHA, WI 53140	NONE PUBLIC	EDUCATIONAL PROGRAMS	6,500.
CHAPMAN UNIVERSITY 1 UNIVERSITY DRIVE ORANGE, CA 92866	NONE PUBLIC	EDUCATIONAL PROGRAMS	24,000
CHARLESTON SOUTHERN UNIVERSITY 9200 UNIVERSITY BOULEVARD CHARLESTON, SC 29406	NONE PUBLIC	EDUCATIONAL PROGRAMS	10,000
CHRISTENDOM COLLEGE 134 CHRISTENDOM DR FRONT ROYAL, VA 22630	NONE PUBLIC	EDUCATIONAL PROGRAMS	5,100.
CHRISTOPHER NEWPORT UNIVERSITY 1 AVENUE OF THE ARTS NEWPORT NEWS, VA 23606-2998	NONE PUBLIC	EDUCATIONAL PROGRAMS	8,000
CLAREMONT MCKENNA COLLEGE 500 E 9TH ST. CLAREMONT, CA 91711-6400	NONE PUBLIC	EDUCATIONAL PROGRAMS	14,000

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
COASTAL CAROLINA UNIVERSITY 119 CHANTICLEER DRIVE, EAST CONWAY, SC 29526	NONE PUBLIC	EDUCATIONAL PROGRAMS	15,000.
COLGATE UNIVERSITY 13 OAK DRIVE WALL 213 HAMILTON, NY 13346	NONE PUBLIC	RETURN OF UNUSED GRANT FUNDS	-1,041.
COLLEGE OF CHARLESTON FOUNDATION 66 GEORGE STREET 301 JAMES B COLGATE HALL CHARLESTON, SC 29424	NONE PUBLIC	EDUCATIONAL PROGRAMS	36,731
COLLEGE OF WILLIAM AND MARY PO BOX 8795 WILLIAMSBURG, VA 23187	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,500
DARTMOUTH COLLEGE DEPARTMENT OF ECONOMICS HANOVER, NH 03755	NONE PUBLIC	EDUCATIONAL PROGRAMS	15,000.
DELAWARE STATE UNIVERSITY 1200 NORTH DUPONT HIGHWAY 6106 ROCKEFELLER HALL DOVER, DE 19901-2277	NONE PUBLIC	EDUCATIONAL PROGRAMS	8,172

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
DELTA STATE UNIVERSITY 1003 W SUNFLOWER ROAD SUITE 900 CLEVELAND, MS 38733	NONE PUBLIC	EDUCATIONAL PROGRAMS	8,000
DUKE UNIVERSITY 81 BEVERLY DRIVE DURHAM, NC 27707	NONE PUBLIC	EDUCATIONAL PROGRAMS	16,281.
DUQUESNE UNIVERSITY 600 FORBES AVENUE PITTSBURGH, PA 15282	NONE PUBLIC	EDUCATIONAL PROGRAMS	25,000
FAYETTEVILLE STATE UNIVERSITY 1200 MURCHISON RD., SBE SUITE 230 FAYETTEVILLE, NC 28301-4298	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,000
FLORIDA GULF COAST UNIVERSITY 10501 FGCU BOULEVARD, SOUTH FORT MYERS, FL 33965	NONE PUBLIC	EDUCATIONAL PROGRAMS	26,000.
GEORGE FOX UNIVERSITY 414 N MERIDIAN STREET NEWBERG, OR 97132	NONE PUBLIC	EDUCATIONAL PROGRAMS	10,892

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FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
GEORGE WASHINGTON UNIVERSITY 805 21ST STREET NW WASHINGTON, DC 20052	NONE PUBLIC	EDUCATIONAL PROGRAMS	86,120
GEORGETOWN UNIVERSITY 37TH AND O STREET NW SUITE 612 WASHINGTON, DC 20057	NONE PUBLIC	EDUCATIONAL PROGRAMS	14,000
GEORGIA COLLEGE & STATE UNIVERSITY 231 W HANCOCK ST MILLEDGEVILLE, GA 31061	NONE PUBLIC	EDUCATIONAL PROGRAMS	8,830
GEORGIA STATE UNIVERSITY FOUNDATION ONE PARK PLACE SOUTH CAMPUS BOX 20 ATLANTA, GA 30302	NONE PUBLIC	EDUCATIONAL PROGRAMS	6,000.
GEORGIA TECH RESEARCH CORPORATION PO BOX 100117 SUITE 549 ATLANTA, GA 30384	NONE PUBLIC	EDUCATIONAL PROGRAMS	15,000
GROVE CITY COLLEGE 100 CAMPUS DRIVE #3010 GROVE CITY, PA 16127	NONE PUBLIC	EDUCATIONAL PROGRAMS	38,100.

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
HAMPDEN-SYDNEY COLLEGE CENTER FOR THE STUDY OF POLITICAL ECONOMY HAMPDEN SYDNEY, VA 23943	NONE PUBLIC	EDUCATIONAL PROGRAMS	35,000
HANOVER COLLEGE 484 BALL DRIVE 1 COLLEGE ROAD HANOVER, IN 47243	NONE PUBLIC	EDUCATIONAL PROGRAMS	5,000.
HILLSDALE COLLEGE 33 E COLLEGE STREET HILLSDALE, MI 49242	NONE PUBLIC	EDUCATIONAL PROGRAMS	23,423
JAMES MADISON INSTITUTE PO BOX 37460 TALLAHASSEE, FL 32315	NONE PUBLIC	EDUCATIONAL PROGRAMS	20,000
JAMES MADISON UNIVERSITY 800 S MAIN ST HARRISONBURG, VA 22807	NONE PUBLIC	EDUCATIONAL PROGRAMS	19,000.
JOHNS HOPKINS UNIVERSITY 100 INTERNATIONAL DRIVE BALTIMORE, MD 21202	NONE PUBLIC	EDUCATIONAL PROGRAMS	9,000

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
LA SIERRA UNIVERSITY 4500 RIVERWALK PKWY RIVERSIDE, CA 92515	NONE PUBLIC	EDUCATIONAL PROGRAMS	10,000.
LAKE FOREST COLLEGE 555 N SHERIDAN ROAD LAKE FOREST, IL 60045	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,500
LINFIELD COLLEGE 900 SE BAKER ST MCMINNVILLE, OR 97128-6894	NONE PUBLIC	EDUCATIONAL PROGRAMS	11,500
LOYOLA UNIVERSITY NEW ORLEANS 6363 ST. CHARLES AVENUE NEW ORLEANS, LA 70118	NONE PUBLIC	EDUCATIONAL PROGRAMS	25,000
MASSACHUSETTS INSTITUTE OF TECHNOLOGY 77 MASSACHUSETTS AVE CAMBRIDGE, MS 02139	NONE PUBLIC	EDUCATIONAL PROGRAMS	25,000
MASSACHUSETTS INSTITUTE OF TECHNOLOGY 77 MASSACHUSETTS AVE CAMBRIDGE, MS 02139	NONE PUBLIC	EDUCATIONAL PROGRAMS	-492.

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
MCKENDREE UNVIERSITY 701 COLLEGE ROAD SUITE 503 LEBANON, IL 62254	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,000
MCNEESE STATE UNIVERSITY PO BOX 90780 SUITE 620 LAKE CHARLES, LA 70609-0780	NONE PUBLIC	EDUCATIONAL PROGRAMS	4,500
METROPOLITAN STATE COLLEGE DENVER FOUNDATION 1512 LARIMER STREET, SUITE 900 DENVER, CO 80217-8424	NONE PUBLIC	EDUCATIONAL PROGRAMS	15,500.
MICHIGAN STATE UNIVERSITY 304 SOUTH CASE HALL CAMPUS BOX 14 EAST LANSING, MI 48825	NONE PUBLIC	EDUCATIONAL PROGRAMS	15,000.
MIDDLE TENNESSEE STATE UNIVERSITY FOUNDATION WOOD-STEGALL CENTER MURFREESBORO, TN 37132	NONE PUBLIC	EDUCATIONAL PROGRAMS	8,000.
MIDWESTERN STATE UNIVERSITY FOUNDATION 3410 TAFT BLVD BOX 109 WICHITA FALLS, TX 76308	NONE PUBLIC	EDUCATIONAL PROGRAMS	4,000

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
MILLIGAN COLLEGE PO BOX 500 MILLIGAN COLLEGE, TN 37682	NONE PUBLIC	EDUCATIONAL PROGRAMS	5,800
MONTCLAIR STATE UNIVERSITY FOUNDATION 1 NORMAL AVENUE MONTCLAIR, NJ 07043	NONE PUBLIC	EDUCATIONAL PROGRAMS	-2,729.
NATIONAL UNIVERSITY 11255 NORTH TORREY PINES RD LA JOLLA, CA 92037	NONE PUBLIC	EDUCATIONAL PROGRAMS	10,000.
NICHOLLS STATE UNIVERSITY PICCIOLA HALL THIBODAUX, LA 70310	NONE PUBLIC	EDUCATIONAL PROGRAMS	4,200.
NORTH CAROLINA STATE UNIVERSITY A HOLLADAY HALL PO BOX 2001 RALEIGH, NC 27695-7001	NONE PUBLIC	EDUCATIONAL PROGRAMS	9,000.
NORTHWESTERN UNIVERSITY 375 E CHICAGO AVE CAMPUS BOX 7001 CHICAGO, IL 60611	NONE PUBLIC	EDUCATIONAL PROGRAMS	750.

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ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
NORTHWOOD UNIVERSITY - FLORIDA 4000 WHITING DRIVE MIDLAND, MI 48640	NONE PUBLIC	EDUCATIONAL PROGRAMS	6,000
OHIO UNIVERSITY FOUNDATION P O. BOX 869 ATHENS, OH 45701	NONE PUBLIC	EDUCATIONAL PROGRAMS	14,000.
OKLAHOMA STATE UNIVERSITY FOUNDATION 400 S MONROE ST STILLWATER, OK 74074	NONE PUBLIC	EDUCATIONAL PROGRAMS	36,400
PATRICK HENRY COLLEGE 10 PATRICK HENRY CIRCLE PURCELLVILLE, VA 20132	NONE PUBLIC	EDUCATIONAL PROGRAMS	8,000
PENNSYLVANIA STATE UNIVERSITY - ERIE BLACK SCHOOL OF BUSINESS ERIE, PA 16563	NONE PUBLIC	EDUCATIONAL PROGRAMS	14,500
PRESBYTERIAN COLLEGE 503 BROAD STREET 5151 JORDAN ROAD CLINTON, SC 29325	NONE PUBLIC	EDUCATIONAL PROGRAMS	2,043

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ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
PROVIDENCE COLLEGE 1 CUNNINGHAM SQUARE PROVIDENCE, RI 02918	NONE PUBLIC	EDUCATIONAL PROGRAMS	8,400
RANDOLPH-MACON COLLEGE PO BOX 5005 ASHLAND, VA 23005	NONE PUBLIC	EDUCATIONAL PROGRAMS	9,000.
REGENT UNIVERSITY REGENT UNIVERSITY DRIVE 60 GARDEN STREET VIRGINIA BEACH, VA 23464-9800	NONE PUBLIC	EDUCATIONAL PROGRAMS	10,000
RHODES COLLEGE 2000 N. PARKWAY ADM 142 MEMPHIS, TN 38112	NONE PUBLIC	EDUCATIONAL PROGRAMS	15,000.
ROBERT MORRIS UNIVERSITY 6001 UNIVERSITY BOULEVARD MOON TOWNSHIP, PA 15108-1189	NONE PUBLIC	EDUCATIONAL PROGRAMS	5,500.
ROCKFORD COLLEGE 5050 EAST STATE STREET ROCKFORD, IL 61108	NONE PUBLIC	EDUCATIONAL PROGRAMS	11,700.

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
ROOSEVELT UNIVERSITY 430 S MICHIGAN AVENUE CHICAGO, IL 60605	NONE PUBLIC	EDUCATIONAL PROGRAMS	8,400
RYAN FOUNDATION 805 BROWER ROAD WAYNE, PA 19087	NONE PUBLIC	EDUCATIONAL PROGRAMS	15,000
SAGINAW VALLEY STATE UNIVERSITY 7400 BAY RD , BROWN 342 UNIVERSITY CENTER, MI 48710	NONE PUBLIC	EDUCATIONAL PROGRAMS	3,650.
SALISBURY UNIVERSITY PO BOX 2655 SALISBURY, MD 21802-2655	NONE PUBLIC	EDUCATIONAL PROGRAMS	12,000
SAN DIEGO STATE UNIVERSITY RESEARCH FOUNDATION 5250 CAMPANILE DRIVE SAN DIEGO, CA 92182	NONE PUBLIC	EDUCATIONAL PROGRAMS	5,500
SARAH LAWRENCE COLLEGE 1 MEAD WAY BRONXVILLE, NY 10708	NONE PUBLIC	EDUCATIONAL PROGRAMS	8,000

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
SETON HALL UNIVERSITY 400 SOUTH ORANGE AVENUE SOUTH ORANGE, NJ 07079	NONE PUBLIC	EDUCATIONAL PROGRAMS	10,780
SKIDMORE COLLEGE 815 NORTH BROADWAY SARATOGA SPRINGS, NY 12866	NONE PUBLIC	EDUCATIONAL PROGRAMS	4,200
SOUTHEAST IDAHO RESEARCH INSTITUTE 310 N. 2ND EAST REXBURG, ID 83440	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,500.
SOUTHERN ILLINOIS UNIVERSITY - CARBONDALE WOODY HALL B-204, MC 4703 SUITE 113 CARBONDALE, IL 62901-4703	NONE PUBLIC	EDUCATIONAL PROGRAMS	17,000.
SOUTHERN UTAH UNIVERSITY 351 WEST UNIVERSITY BOULEVARD SUITE 1500 CEDAR CITY, UT 84720	NONE PUBLIC	EDUCATIONAL PROGRAMS	9,200.
ST AMBROSE UNIVERSITY 518 W LOCUST STREET DAVENPORT, IA 52803	NONE PUBLIC	EDUCATIONAL PROGRAMS	5,400

FORM 990PF, PART XV - GRANTS AND CONTRIBUTIONS PAID DURING THE YEAR

ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
ST. CLOUD STATE UNIVERSITY FOUNDATION 720 4TH AVENUE SOUTH SAINT CLOUD, MN 56301-4498	NONE PUBLIC	EDUCATIONAL PROGRAMS	6,000.
ST EDWARDS UNIVERSITY 3001 S CONGRESS AVE AUSTIN, TX 78704	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,000
ST. JOHN'S UNIVERSITY 8000 UTOPIA PARKWAY QUEENS, NY 11439	NONE PUBLIC	EDUCATIONAL PROGRAMS	29,562.
ST LAWRENCE UNIVERSITY 23 ROMODA DRIVE CANTON, NY 13617	NONE PUBLIC	EDUCATIONAL PROGRAMS	14,000
STATE UNIVERSITY OF NEW YORK - PLATTSBURGH P.O. BOX 9 ALBANY, NY 12201	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,500
STEPHEN F. AUSTIN STATE UNIVERSITY BOX 13004, SFA STATION NACOGDOCHES, TX 75962-3004	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,000

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ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
SUFFOLK UNIVERSITY 8 ASHBURTON PLACE BOSTON, MS 02108-2770	NONE PUBLIC	EDUCATIONAL PROGRAMS	19,000
TEXAS A&M UNIVERSITY 217 JOHN J KOLDUS BUILDING COLLEGE STATION, TX 77843	NONE PUBLIC	EDUCATIONAL PROGRAMS	9,000
TEXAS STATE UNIVERSITY 601 UNIVERSITY DRIVE SAN MARCOS, TX 78666	NONE PUBLIC	RETURN OF UNUSED GRANT FUNDS	-954.
THE COLLEGE OF NEW JERSEY P O BOX 7718 EWING, NJ 08628	NONE PUBLIC	EDUCATIONAL PROGRAMS	11,900.
THE RESEARCH FOUNDATION 35 STATE STREET ALBANY, NY 12207-2826	NONE PUBLIC	RETURN OF UNUSED GRANT FUNDS	-219.
TOWER FOUNDATION OF SAN JOSE STATE UNIVERSITY SAN JOSE, CA 95192	NONE PUBLIC	EDUCATIONAL PROGRAMS	25,000

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ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
TRINITY COLLEGE 300 SUMMIT STREET ONE WASHINGTON SQUARE HARTFORD, CT 06106	NONE PUBLIC	EDUCATIONAL PROGRAMS	11,200
TRINITY UNIVERSITY 1 TRINITY PL. SAN ANTONIO, TX 78212	NONE PUBLIC	EDUCATIONAL PROGRAMS	8,000.
UCLA FOUNDATION 10920 WILSHIRE BOULEVARD LOS ANGELES, CA 90024	NONE PUBLIC	EDUCATIONAL PROGRAMS	9,000.
UNIVERSITY OF AKRON 302 BUCHTEL COMMONS SUITE 900 AKRON, OH 44325	NONE PUBLIC	EDUCATIONAL PROGRAMS	9,500.
UNIVERSITY OF ALABAMA - HUNTSVILLE 301 SPARKMAN DR THE UNIVERSITY OF AKRON HUNTSVILLE, AL 35899	NONE PUBLIC	RETURN OF UNUSED GRANT FUNDS	-26.
UNIVERSITY OF ALABAMA - HUNTSVILLE 301 SPARKMAN DR HUNTSVILLE, AL 35899	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,000

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ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
UNIVERSITY OF ALABAMA AT BIRMINGHAM 1400 UNIVERSITY BLVD , BOX 70 BIRMINGHAM, AL 35294-1150	NONE PUBLIC	EDUCATIONAL PROGRAMS	4,874.
UNIVERSITY OF ALASKA - FAIRBANKS 505 SOUTH CHANDALAR DRIVE FAIRBANKS, AL 99775	NONE PUBLIC	EDUCATIONAL PROGRAMS	14,800
UNIVERSITY OF ARKANSAS FOUNDATION 535 RESEARCH CENTER BLVD P.O BOX 757500 FAYETTEVILLE, AR 72701	NONE PUBLIC	RETURN OF UNUSED GRANT FUNDS	-3,826.
UNIVERSITY OF ARKANSAS-LITTLE ROCK 2801 SOUTH UNIVERSITY AVE STE 120 LITTLE ROCK, AR 72204-1099	NONE PUBLIC	EDUCATIONAL PROGRAMS	15,000.
UNIVERSITY OF CALIFORNIA ONE SHIELDS AVENUE DAVIS, CA 95616	NONE PUBLIC	RETURN OF UNUSED GRANT FUNDS	-439.
UNIVERSITY OF CENTRAL ARKANSAS FOUNDATION UCR BOX 4986 CONWAY, AR 72035-4986	NONE PUBLIC	EDUCATIONAL PROGRAMS	10,200

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ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
UNIVERSITY OF COLORADO FOUNDATION CORPORATE FOUNDATION RELATIONS BOULDER, CO 80302	NONE PUBLIC	EDUCATIONAL PROGRAMS	12,000
UNIVERSITY OF DALLAS 1845 E. NORTHGATE DR. 1305 UNIVERSITY AVENUE IRVING, TX 75062	NONE PUBLIC	EDUCATIONAL PROGRAMS	26,000
UNIVERSITY OF DAYTON 300 COLLEGE PARK DAYTON, OH 45469	NONE PUBLIC	EDUCATIONAL PROGRAMS	15,500.
UNIVERSITY OF HOUSTON 4381 HARVEST LN HOUSTON, TX 77204-3011	NONE PUBLIC	EDUCATIONAL PROGRAMS	10,000
UNIVERSITY OF MAINE - ORONO 5703 ALUMNI HALL PORTLAND, ME 04469	NONE PUBLIC	EDUCATIONAL PROGRAMS	3,200.
UNIVERSITY OF MARYLAND - BALTIMORE COUNTY 1000 HILLTOP CIRCLE SUITE 200 BALTIMORE, MD 21250	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,400.

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ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
UNIVERSITY OF MEMPHIS 341 ADMINISTRATION BUILDING 319 PUBLIC POLICY BLDG MEMPHIS, TN 38152	NONE PUBLIC	EDUCATIONAL PROGRAMS	5,900
UNIVERSITY OF MICHIGAN 611 TAPPAN ST ANN ARBOR, MI 48109-1003	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,000
UNIVERSITY OF MISSISSIPPI PO BOX 1848 UNIVERSITY, MS 38677	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,000
UNIVERSITY OF MISSOURI - COLUMBIA 904 VIRGINIA AVE COLUMBIA, MO 65201	NONE PUBLIC	EDUCATIONAL PROGRAMS	34,500
UNIVERSITY OF NEBRASKA - OMAHA 6001 DODGE STREET OMAHA, NE 68182	NONE PUBLIC	EDUCATIONAL PROGRAMS	10,000
UNIVERSITY OF NORTH ALABAMA FOUNDATION ONE HARRISON PLAZA FLORENCE, AL 35632	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,000

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ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
UNIVERSITY OF NORTH CAROLINA - GREENSBORO PO BOX 26170 GREENSBORO, NC 27402-6170	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,500.
UNIVERSITY OF RICHMOND G - 17 MARYLAND HALL UNIV OF RICHMOND, VA 23173	NONE PUBLIC	EDUCATIONAL PROGRAMS	14,000.
UNIVERSITY OF SAN DIEGO 5998 ALCALA PARK SAN DIEGO, CA 92110	NONE PUBLIC	EDUCATIONAL PROGRAMS	10,303
UNIVERSITY OF SOUTH FLORIDA FOUNDATION 4202 E FOWLER AVENUE, ALC100 TAMPA, FL 33620	NONE PUBLIC	EDUCATIONAL PROGRAMS	2,500
UNIVERSITY OF TEXAS - ARLINGTON 701 S NEDDERMAN DRIVE ARLINGTON, TX 76019	NONE PUBLIC	EDUCATIONAL PROGRAMS	8,000
UNIVERSITY OF TEXAS - AUSTIN 1 UNIVERSITY STATION AUSTIN, TX 78712	NONE PUBLIC	EDUCATIONAL PROGRAMS	9,000

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ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
UNIVERSITY OF TEXAS - SAN ANTONIO ONE UTSA CIRCLE SAN ANTONIO, TX 78249	NONE PUBLIC	EDUCATIONAL PROGRAMS	11,500
UNIVERSITY OF TULSA 800 SOUTH TUCKER DRIVE TULSA, OK 74104	NONE PUBLIC	EDUCATIONAL PROGRAMS	5,000.
UNIVERSITY OF VIRGINIA C/O UVA OFFICE OF SPONSORED PROGRAMS CHARLOTTESVILLE, VA 22904	NONE PUBLIC	EDUCATIONAL PROGRAMS	23,000
UNIVERSITY OF VIRGINIA'S COLLEGE AT WISE ONE COLLEGE AVENUE PO BOX 400195 WISE, VA 24293	NONE PUBLIC	EDUCATIONAL PROGRAMS	6,000
UNIVERSITY OF WEST FLORIDA FOUNDATION 11000 UNIVERSITY PARKWAY PENSACOLA, FL 32514	NONE PUBLIC	EDUCATIONAL PROGRAMS	12,500.
UNIVERSITY OF WISCONSIN FOUNDATION - EAU CLAIRE 105 GARFIELD AVENUE EAU CLAIRE, WI 54702-5000	NONE PUBLIC	RETURN OF UNUSED GRANT FUNDS	-1,418

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ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
UNIVERSITY OF WISCONSIN FOUNDATION 1848 UNIVERSITY AVENUE MADISON, WI 53726	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,000
UNLV FOUNDATION 4505 S MARYLAND PKWY LAS VEGAS, NV 89154	NONE PUBLIC	EDUCATIONAL PROGRAMS	10,000
UTAH STATE UNIVERSITY 1400 OLD MAIN HILL PO BOX 451006 LOGAN, UT 84322-1400	NONE PUBLIC	EDUCATIONAL PROGRAMS	45,000
WASHINGTON UNIVERSITY - ST LOUIS ONE BROOKINGS DRIVE ST LOUIS, MO 63130	NONE PUBLIC	EDUCATIONAL PROGRAMS	6,000
WEBBER INTERNATIONAL UNIVERSITY 1201 N SCENIC HWY BABSON PARK, FL 33827	NONE PUBLIC	EDUCATIONAL PROGRAMS	3,000
WESLEYAN COLLEGE 4760 FORSYTH ROAD MACON, GA 31210	NONE PUBLIC	EDUCATIONAL PROGRAMS	6,300.

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ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
WEST TEXAS A&M UNIVERSITY 2501 4TH AVENUE CANYON, TX 79016	NONE PUBLIC	EDUCATIONAL PROGRAMS	2,000
WEST VIRGINIA UNIVERSITY FOUNDATION 1 WATERFRONT PLACE 7TH FLOOR MORGANTOWN, WV 26507-1650	NONE PUBLIC	EDUCATIONAL PROGRAMS	11,000
WESTERN CAROLINA UNIVERSITY AFIE DEPARTMENT, FO 121 PO BOX 1650 CULLOWHEE, NC 28723	NONE PUBLIC	EDUCATIONAL PROGRAMS	12,000.
WESTERN KENTUCKY UNIVERSITY RESEARCH FOUNDATION 1906 COLLEGE HEIGHTS BLVD COLLEGE OF BUSINESS BOWLING GREEN, KY 42101	NONE PUBLIC	EDUCATIONAL PROGRAMS	11,700
WESTERN MICHIGAN UNIVERSITY 1903 W MICHIGAN AVE KALAMAZOO, MI 49008-5330	NONE PUBLIC	EDUCATIONAL PROGRAMS	14,100.
WESTMONT COLLEGE 955 LA PAZ ROAD 5307 FRIEDMANN HALL SANTA BARBARA, CA 93108	NONE PUBLIC	EDUCATIONAL PROGRAMS	3,000.

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ATTACHMENT 16 (CONT'D)

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
WHEATON COLLEGE 501 COLLEGE AVE WHEATON, IL 60187-5593	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,300
WISCONSIN LUTHERAN COLLEGE 8800 W. BLUEMOUND RD. MILWAUKEE, WI 53226	NONE PUBLIC	EDUCATIONAL PROGRAMS	7,500.
CHARLES KOCH INSTITUTE 1515 N COURTHOUSE ROAD ARLINGTON, VA 22201	RELATED PARTY PRIVATE	EDUCATIONAL PROGRAMS	2,800,000.
FRASER INSTITUTE 1770 BURRARD ST , 4TH FLOOR V6J 3G7 VANCOUVER BRITISH COLUMBIA CANADA	NONE PUBLIC	GENERAL OPERATING SUPPORT	150,000
MCGILL UNIVERSITY 855 SHERBROOKE ST. W H3A 2T7 MONTREAL QUEBE CANADA	NONE PUBLIC	EDUCATIONAL PROGRAMS	8,000
		TOTAL CONTRIBUTIONS PAID	16,345,918.

FORM 990PF, PART XV - CONTRIBUTIONS APPROVED FOR FUTURE PAYMENT

ATTACHMENT 17

RECIPIENT NAME AND ADDRESS	RELATIONSHIP TO SUBSTANTIAL CONTRIBUTOR AND FOUNDATION STATUS OF RECIPIENT	PURPOSE OF GRANT OR CONTRIBUTION	AMOUNT
FLORIDA STATE UNIVERSITY 211 WESTCOTT BUILDING TALLAHASSEE, FL 32306-1470	NONE PUBLIC	PHD STUDENT FELLOWSHIPS	230,355
NEW YORK UNIVERSITY 19 W 4TH STREET NEW YORK, NY 10012	NONE PUBLIC	LEGAL FELLOWSHIP	35,500
SUFFOLK UNIVERSITY 8 ASHBURTON PLACE BOSTON, MA 02108-2770	NONE PUBLIC	PHD STUDENT FELLOWSHIPS	33,751.
TROY UNIVERSITY FOUNDATION 211 WRIGHT HALL TROY, AL 36082	NONE PUBLIC	MANUAL H JOHNSON CENTER FOR POLITICAL ECONOMY	720,000
		TOTAL CONTRIBUTIONS APPROVED	1,019,606

SCHEDULE D
(Form 1041)
Department of the Treasury
Internal Revenue Service

Capital Gains and Losses

▶ Attach to Form 1041, Form 5227, or Form 990-T. See the Instructions for Schedule D (Form 1041) (also for Form 5227 or Form 990-T, if applicable).

OMB No 1545-0092

2011

Name of estate or trust	Employer identification number
CHARLES KOCH FOUNDATION	48-0918408

Note: *Form 5227 filers need to complete **only** Parts I and II*

Part I Short-Term Capital Gains and Losses - Assets Held One Year or Less

	(a) Description of property (Example 100 shares 7% preferred of "Z" Co)	(b) Date acquired (mo, day, yr)	(c) Date sold (mo, day, yr)	(d) Sales price	(e) Cost or other basis (see instructions)	(f) Gain or (loss) for the entire year Subtract (e) from (d)
1a						

b	Enter the short-term gain or (loss), if any, from Schedule D-1, line 1b	1b	1,758,008.
2	Short-term capital gain or (loss) from Forms 4684, 6252, 6781, and 8824	2	
3	Net short-term gain or (loss) from partnerships, S corporations, and other estates or trusts	3	
4	Short-term capital loss carryover Enter the amount, if any, from line 9 of the 2010 Capital Loss Carryover Worksheet	4	( )
5	**Net short-term gain or (loss).** Combine lines 1a through 4 in column (f) Enter here and on line 13, column (3) on the back ▶	5	1,758,008.

Part II Long-Term Capital Gains and Losses - Assets Held More Than One Year

	(a) Description of property (Example 100 shares 7% preferred of "Z" Co)	(b) Date acquired (mo, day, yr)	(c) Date sold (mo, day, yr)	(d) Sales price	(e) Cost or other basis (see instructions)	(f) Gain or (loss) for the entire year Subtract (e) from (d)
6a						

b	Enter the long-term gain or (loss), if any, from Schedule D-1, line 6b	6b	787,104.
7	Long-term capital gain or (loss) from Forms 2439, 4684, 6252, 6781, and 8824	7	
8	Net long-term gain or (loss) from partnerships, S corporations, and other estates or trusts	8	
9	Capital gain distributions	9	
10	Gain from Form 4797, Part I	10	
11	Long-term capital loss carryover Enter the amount, if any, from line 14 of the 2010 Capital Loss Carryover Worksheet	11	( )
12	**Net long-term gain or (loss).** Combine lines 6a through 11 in column (f) Enter here and on line 14a, column (3) on the back ▶	12	787,104.

For Paperwork Reduction Act Notice, see the Instructions for Form 1041. **Schedule D (Form 1041) 2011**

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Part III **Summary of Parts I and II** **Caution:** *Read the instructions* ***before*** *completing this part*		**(1)** Beneficiaries' (see instr)	**(2)** Estate's or trust's	**(3)** Total
13 Net short-term gain or (loss)	13			1,758,008.
14 Net long-term gain or (loss):				
a Total for year	14a			787,104.
b Unrecaptured section 1250 gain (see line 18 of the wrksht)	14b			
c 28% rate gain	14c			
15 Total net gain or (loss). Combine lines 13 and 14a ▶	15			2,545,112.

Note: *If line 15, column (3), is a net gain, enter the gain on Form 1041, line 4 (or Form 990-T, Part I, line 4a) If lines 14a and 15, column (2), are net gains, go to Part V, and* ***do not*** *complete Part IV If line 15, column (3), is a net loss, complete Part IV and the* ***Capital Loss Carryover Worksheet,*** *as necessary*

Part IV Capital Loss Limitation

16 Enter here and enter as a (loss) on Form 1041, line 4 (or Form 990-T, Part I, line 4c, if a trust), the **smaller** of
a The loss on line 15, column (3) or b $3,000 . . . 16 (   )

Note: *If the loss on line 15, column (3), is more than $3,000,* ***or*** *if Form 1041, page 1, line 22 (or Form 990-T, line 34), is a loss, complete the* ***Capital Loss Carryover Worksheet*** *in the instructions to figure your capital loss carryover*

Part V Tax Computation Using Maximum Capital Gains Rates

Form 1041 filers. Complete this part **only** if both lines 14a and 15 in column (2) are gains, or an amount is entered in Part I or Part II and there is an entry on Form 1041, line 2b(2), **and** Form 1041, line 22, is more than zero

Caution: *Skip this part and complete the* ***Schedule D Tax Worksheet*** *in the instructions if*

- *Either line 14b, col (2) or line 14c, col (2) is more than zero, or*
- *Both Form 1041, line 2b(1), and Form 4952, line 4g are more than zero*

Form 990-T trusts. Complete this part **only** if both lines 14a and 15 are gains, or qualified dividends are included in income in Part I of Form 990-T, **and** Form 990-T, line 34, is more than zero Skip this part and complete the **Schedule D Tax Worksheet** in the instructions if either line 14b, col (2) or line 14c, col (2) is more than zero

17 Enter taxable income from Form 1041, line 22 (or Form 990-T, line 34) . . . 17
18 Enter the **smaller** of line 14a or 15 in column (2) but not less than zero . . . 18
19 Enter the estate's or trust's qualified dividends from Form 1041, line 2b(2) (or enter the qualified dividends included in income in Part I of Form 990-T) . . 19
20 Add lines 18 and 19 . . . 20
21 If the estate or trust is filing Form 4952, enter the amount from line 4g, otherwise, enter -0- . . ▶ 21
22 Subtract line 21 from line 20 If zero or less, enter -0- . . . 22
23 Subtract line 22 from line 17 If zero or less, enter -0- . . . 23
24 Enter the **smaller** of the amount on line 17 or $2,300 . . . 24
25 Is the amount on line 23 equal to or more than the amount on line 24?
☐ **Yes.** Skip lines 25 and 26, go to line 27 and check the "No" box.
☐ **No.** Enter the amount from line 23 . . . 25
26 Subtract line 25 from line 24 . . . 26
27 Are the amounts on lines 22 and 26 the same?
☐ **Yes.** Skip lines 27 thru 30; go to line 31 ☐ **No.** Enter the smaller of line 17 or line 22 27
28 Enter the amount from line 26 (If line 26 is blank, enter -0-) . . . 28
29 Subtract line 28 from line 27 . . . 29
30 Multiply line 29 by 15% (15) . . . 30
31 Figure the tax on the amount on line 23 Use the 2011 Tax Rate Schedule for Estates and Trusts (see the Schedule G instructions in the instructions for Form 1041) . . . 31
32 Add lines 30 and 31 . . . 32
33 Figure the tax on the amount on line 17 Use the 2011 Tax Rate Schedule for Estates and Trusts (see the Schedule G instructions in the instructions for Form 1041) . . . 33
34 **Tax on all taxable income.** Enter the **smaller** of line 32 or line 33 here and on Form 1041, Schedule G, line 1a (or Form 990-T, line 36) . . . 34

SCHEDULE D-1
(Form 1041)

Department of the Treasury
Internal Revenue Service

Continuation Sheet for Schedule D (Form 1041)

▶ See instructions for Schedule D (Form 1041).
▶ Attach to Schedule D to list additional transactions for lines 1a and 6a.

OMB No 1545-0092

2011

Name of estate or trust	Employer identification number
CHARLES KOCH FOUNDATION	48-0918408

Part I Short-Term Capital Gains and Losses - Assets Held One Year or Less

(a) Description of property (Example 100 sh 7% preferred of "Z" Co)	(b) Date acquired (mo, day, yr)	(c) Date sold (mo, day, yr)	(d) Sales price	(e) Cost or other basis (see instructions)	(f) Gain or (loss) Subtract (e) from (d)
1a ZAZOVE ASSOCIATES, LLC	VARIOUS	VARIOUS	972,037.	994,248.	-22,211.
ACIS CLO	VARIOUS	VARIOUS	8,964,429.	8,791,432.	172,997.
PILOT TRAVEL CENTERS	VARIOUS	VARIOUS	11,607,222.	10,000,000.	1,607,222.
1b Total. Combine the amounts in column (f) Enter here and on Schedule D, line 1b					1,758,008.

For Paperwork Reduction Act Notice, see the Instructions for Form 1041. **Schedule D-1 (Form 1041) 2011**

Name of estate or trust as shown on Form 1041 Do not enter name and employer identification number if shown on the other side	Employer identification number

Part II Long-Term Capital Gains and Losses - Assets Held More Than One Year

(a) Description of property (Example 100 sh 7% preferred of "Z" Co)	(b) Date acquired (mo , day, yr)	(c) Date sold (mo , day, yr)	(d) Sales price	(e) Cost or other basis (see instructions)	(f) Gain or (loss) Subtract (e) from (d)
6a ZAZOVE ASSOCIATES, LLC	VARIOUS	VARIOUS	2,020,548.	1,845,833.	174,715.
ACIS CLO	VARIOUS	VARIOUS	1,308,000.	1,610,000.	-302,000.
PIMCO	VARIOUS	VARIOUS	27,459,154.	26,569,477.	889,677.
EATON VANCE	VARIOUS	VARIOUS	331,278.	306,566.	24,712.

6b Total. Combine the amounts in column (f) Enter here and on Schedule D, line 6b . . . . 787,104.

CHARLES KOCH FOUNDATION

2011

48-0918408

Description of Property

DEPRECIATION

Asset description	Date placed in service	Unadjusted Cost or basis	Bus %	179 exp reduction in basis	Basis Reduction	Basis for depreciation	Beginning Accumulated depreciation	Ending Accumulated depreciation	Me-thod	Conv	Life	ACRS class	M A CRS class	Current-year 179 expense	Current-year depreciation
OFFICE EQUIPMENT	VAR	16,630	100 000			16,630		1,440	SL						1,440.
UNIMPROVED LAND	05/13/1988	3,377,694	100 000												
LEASEHOLD IMPROVE	VAR	1,000,652	100 000			1,000,652	613,038.	807,679	SL						194,641
LEASEHOLD IMPROVE	VAR	2,932	100 000			2,932		272	SL						272
Less Retired Assets															
Subtotals		4,397,908				1,020,214	613,038	809,391							196,353

Listed Property

Asset description	Date placed in service	Unadjusted Cost or basis	Bus %	179 exp reduction in basis	Basis Reduction	Basis for depreciation	Beginning Accumulated depreciation	Ending Accumulated depreciation	Me-thod	Conv	Life	ACRS class	M A CRS class	Current-year 179 expense	Current-year depreciation
Less: Retired Assets															
Subtotals															
TOTALS		4,397,908				1,020,214	613,038	809,391.							196,353

AMORTIZATION

Asset description	Date placed in service	Cost or basis	Accumulated amortization	Ending Accumulated amortization	Code	Life	Current-year amortization
TOTALS							

*Assets Retired

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Form 8868 (Rev 1-2012) Page **2**

- If you are filing for an **Additional (Not Automatic) 3-Month Extension, complete only Part II** and check this box . . . . ▶ ☒

Note. Only complete Part II if you have already been granted an automatic 3-month extension on a previously filed Form 8868

- If you are filing for an **Automatic 3-Month Extension, complete only Part I** (on page 1)

Part II Additional (Not Automatic) 3-Month Extension of Time. Only file the original (no copies needed)

Enter filer's identifying number, see instructions

Type or print	Name of exempt organization or other filer, see instructions CHARLES G. KOCH CHARITABLE FOUNDATION	Employer identification number (EIN) or ☒ 48-0918408
File by the due date for filing your return See instructions	Number, street, and room or suite no If a P O box, see instructions P.O. BOX 2256	Social security number (SSN) ☐
	City, town or post office, state, and ZIP code. For a foreign address, see instructions WICHITA, KS 67201-2256	

Enter the Return code for the return that this application is for (file a separate application for each return) 0 4

Application Is For	Return Code	Application Is For	Return Code
Form 990	01		
Form 990-BL	02	Form 1041-A	08
Form 990-EZ	01	Form 4720	09
Form 990-PF	04	Form 5227	10
Form 990-T (sec 401(a) or 408(a) trust)	05	Form 6069	11
Form 990-T (trust other than above)	06	Form 8870	12

STOP! Do not complete Part II if you were not already granted an automatic 3-month extension on a previously filed Form 8868.

- The books are in the care of ▶ HEATHER LOVE

  Telephone No ▶ 316 828-8286 FAX No ▶

- If the organization does not have an office or place of business in the United States, check this box . . . . ▶ ☐
- If this is for a Group Return, enter the organization's four digit Group Exemption Number (GEN) ________ If this is for the whole group, check this box . . . . . . ▶ ☐ If it is for part of the group, check this box . . . . ▶ ☐ and attach a list with the names and EINs of all members the extension is for

4 I request an additional 3-month extension of time until 11/15 , 20 12

5 For calendar year 2011 , or other tax year beginning __________, 20____, and ending __________, 20____

6 If the tax year entered in line 5 is for less than 12 months, check reason ☐ Initial return ☐ Final return ☐ Change in accounting period

7 State in detail why you need the extension ADDITIONAL TIME IS REQUIRED TO ACCUMULATE THE INFORMATION NECESSARY TO FILE A COMPLETE AND ACCURATE RETURN.

8a	If this application is for Form 990-BL, 990-PF, 990-T, 4720, or 6069, enter the tentative tax, less any nonrefundable credits See instructions	**8a**	$ 0
b	If this application is for Form 990-PF, 990-T, 4720, or 6069, enter any refundable credits and estimated tax payments made Include any prior year overpayment allowed as a credit and any amount paid previously with Form 8868	**8b**	$ 0
c	**Balance Due.** Subtract line 8b from line 8a Include your payment with this form, if required, by using EFTPS (Electronic Federal Tax Payment System) See instructions	**8c**	$ 0

Signature and Verification must be completed for Part II only.

Under penalties of perjury, I declare that I have examined this form, including accompanying schedules and statements, and to the best of my knowledge and belief, it is true, correct, and complete, and that I am authorized to prepare this form

Signature ▶ Title ▶ Date ▶

Form **8868** (Rev 1-2012)

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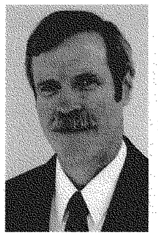
Expert

John Christy

Director, Earth System Science Center, University of Alabama - Huntsville

Professor of atmospheric science and director of the Earth System Science Center at the University of Alabama in Huntsville. In November 2000 Gov. Don Siegelman appointed him to be Alabama's State Climatologist. Awarded NASA's Medal for Exceptional Scientific Achievement in 1991. In January 2002 was inducted as a Fellow of the American Meteorological Society. Received his Ph.D. in Atmospheric Science from the University of Illinois in 1987.



Email: john.christy@nsstc.uah.edu

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